TECHNOLOGY DEPT

POWER

JULY, 1944

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DETROIT

POWER GENERATION, TRANSMISSION, APPLICATION AND THE ATTENDANT SERVICES IN ALL INDUSTRY

Suggesting future wonders, 18,000-hp motor drives big fan to test plane models in 700-mph air blast. *Page 95*

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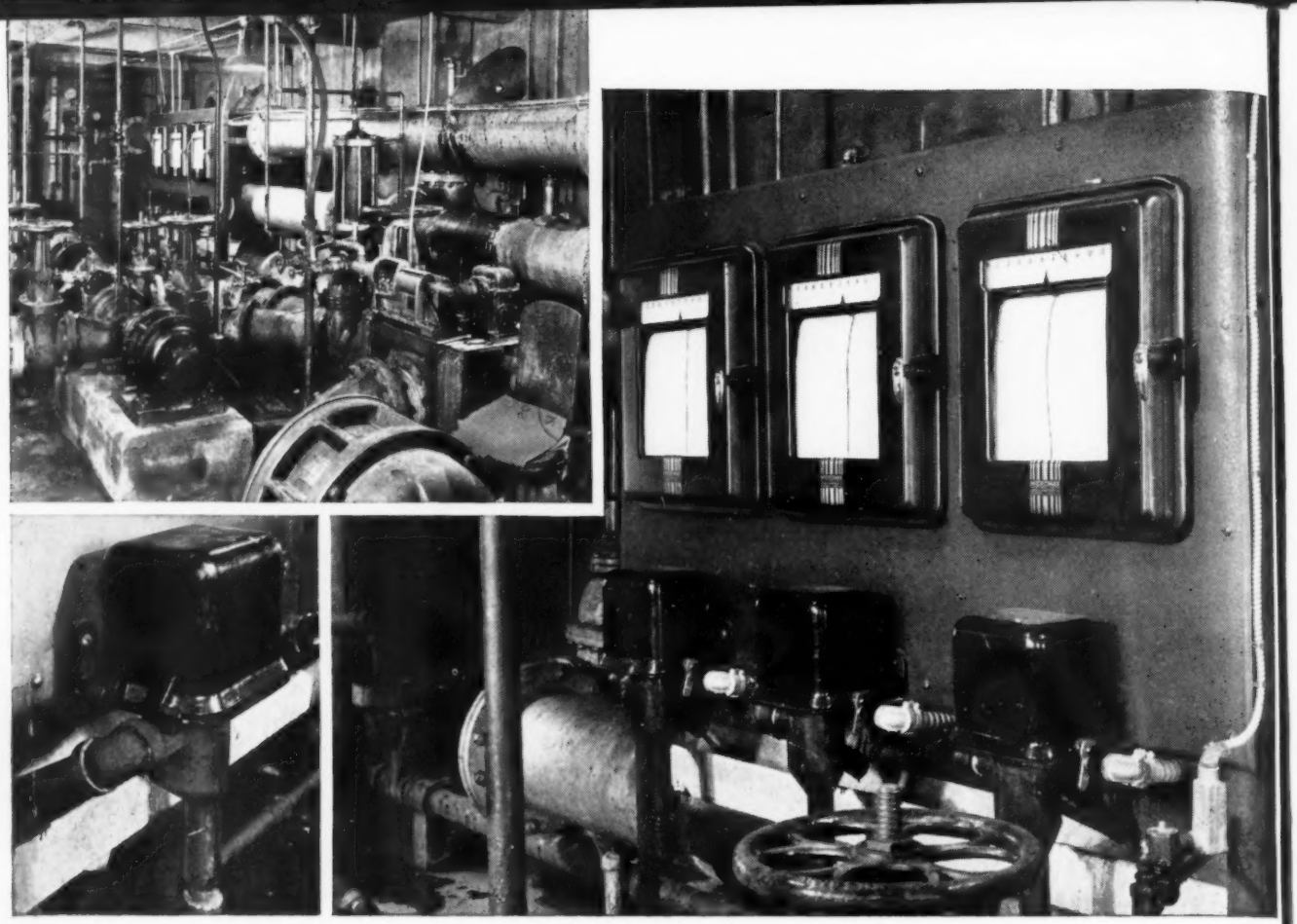
Page 59

Welding repairs on four 115,000-hp Boulder Dam turbines built up pitted areas caused by cavitation, avoiding need for new runners. Over 30,000 sq in. of pitted area were treated with 3460 lb of welding rod. For details of methods used in this outstanding job, see page 64

Power trains of 5000-kw capacity will supply readily available energy to bring the production front closer to advancing Allied armies. For engineering description of these versatile mobile rail units, turn to page 75



Typical views in the filter plant, Finishing Division of Arkwright Corp., Fall River, Mass. The three Micromax Recorders show, left to right, the pH of finished water at the clear well; pH of raw water coming into filter plant; pH of water just after alum and filters. Note electrode unit at left.

FOR HELP IN WATER CONDITIONING

Micromax Solves Arkwright's pH Recording Problem

Efficiency of water-treatment in the Arkwright Finishing Division has been considerably improved because of the complete, quick and accurate pH information which the filter plant operators get from the three Micromax pH Recorders shown above. Starting with raw water which varies from 5 to 9 pH, and treating it to a value slightly above 7, the plant had for years done a good job, but never before did it operate so easily and efficiently as since 1942, when the Micromax Recorders were installed.

Instruments selected by Arkwright for this service are our Strip-Chart Signalling Recorders; these are self-standardizing and fully automatic; they operate alarms if pH exceeds preset limits; they can be equipped at any time to handle automatic-control problems. They record in great detail, and their range is 2–12 pH, which gives ample working space on both sides of any pH value normally held in an industrial application.

The electrodes employed are our modern, flow-type glass and calomel units, sturdily made and securely housed in the metal boxes shown below the Recorders. They receive water by pipe and discharge into the trough for return to the mill's raw-water supply.

Different conditions from those at the Arkwright plant might of course call for different pH equipment; a Round-Chart Micromax, perhaps, and a different type of glass electrode. If you have a pH recording problem and will outline it, an L&N engineer will be glad to help select, from the various types of L&N equipment, that which will meet your needs.

Jrl Ad N-96-701(2)

V depends on me!

A Slogan For Every American

LEEDS & NORTHRUP COMPANY, 4910 STENTON AVE., PHILA., PA.

LEEDS & NORTHRUP

MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), July, 1944, Vol 88, No. 7. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc. Publication office, 99-129 North Broadway, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter, August 25, 1936, at Albany, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, Power, 330 West 42nd Street, New York 18, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for two years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions, 36 shillings per year. All other countries, $6.00 for one year, $9.00 for two years. Single copies 35 cents.

How a Small Steam Plant Solved a Coal Handling Problem

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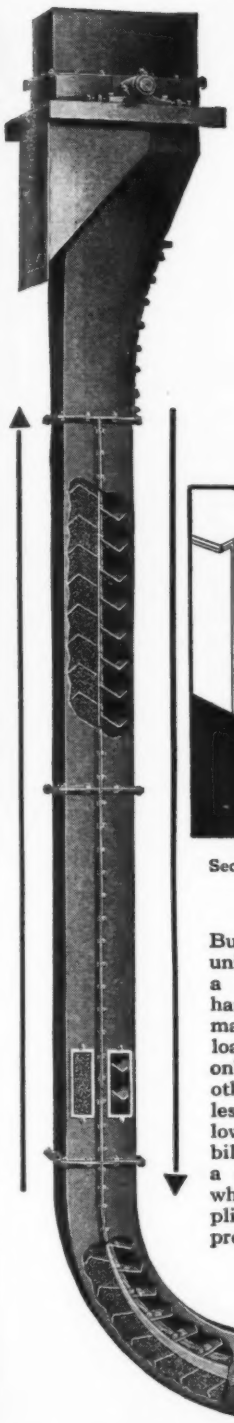
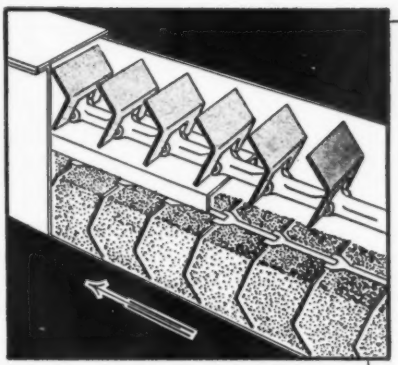


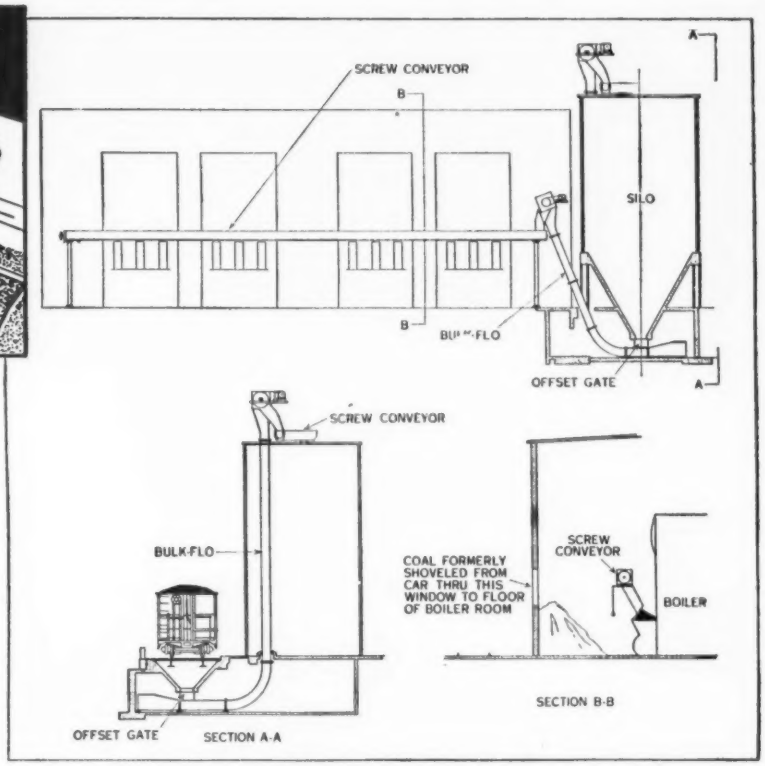
● Coal handling problems vary but all successful solutions require engineering experience and a wide variety of conveying equipment such as Link-Belt Company manufactures. Here is how a mid-west plant, burning from 5 to 10 cars of coal per day successfully solved their problem. Slow, dusty, labor wasting and costly hand shoveling has been replaced with this simple, clean, compact Link-Belt conveyor system. Coal from hopper bottom railroad cars is delivered to storage silo (200-ton capacity) with a Bulk-Flo elevator-conveyor (capable of handling 30 tons of coal per hour). On top of silo is a short horizontal screw conveyor discharging coal to center of silo. Another Bulk-Flo elevator-conveyor (capable of handling 15 tons per hour) delivers the coal from the silo to a horizontal screw conveyor which feeds all twelve stoker hoppers of the four boilers. Link-Belt is prepared to help you solve your problems. Send for Catalogs.

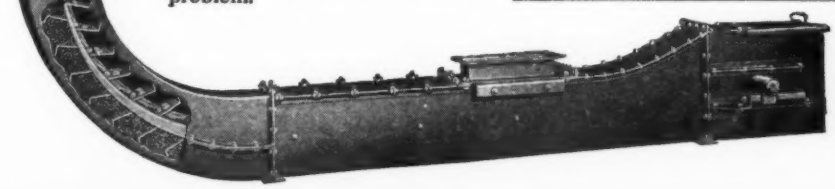


Section of Bulk-Flo elevator-conveyor.

●

Bulk-Flo combines in a single unit the functions of an elevator, a conveyor and feeder. It handles coal and other flowable materials under all conditions of loading. Installation requires only a fraction of the space of other conveyors and elevators—less supporting structures, shallower pits, etc. Extreme flexibility of layout makes possible a simple, low-cost solution to what might otherwise be a complicated, expensive handling problem.





LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Toronto 8. Offices in principal cities.

9494

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. . . Coal and Ashes Handling Equipment

CONVEYORS·ELEVATORS·SKIP HOISTS·CRUSHERS·LARRIES·STOKERS

Rebuilding a World

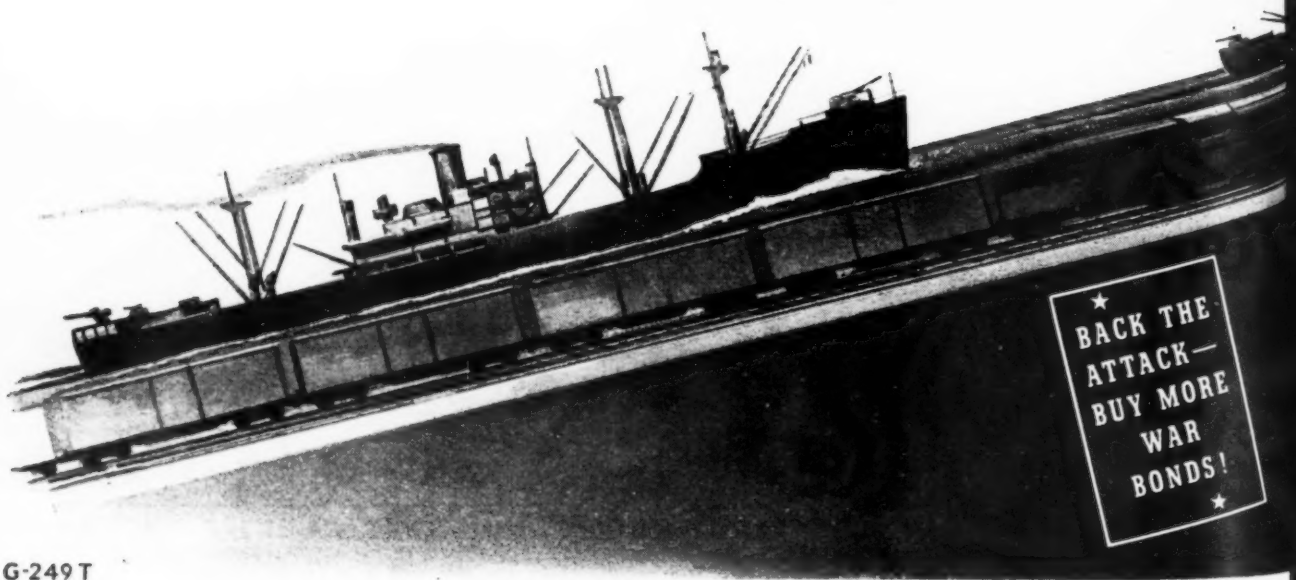
for STEAM

The tough tasks of steam plant rehabilitation and development, will fall on engineers who are now serving their country in the armed forces, or in the never-ending battle with power-plant problems in war plants and in public utility plants supplying power to war plants. In this they are applying their engineering knowledge and skills to the early conclusion of hostilities.

When the war will have ended and Victory is ours, these engineers will re-direct their knowledge and skills from war-making activities to the production of steam power for peaceful pursuits, utilizing whatever of their background of war experience is applicable to future industrial development.

We of Babcock & Wilcox have implicit confidence in their resourcefulness, confidence in their ability to continue overcoming almost impossible assignments. Serving other engineers has also kept us on our mettle, as evidenced by important B&W contributions to the continued evolution of practice in steam generation.

While the war effort has first call on your industry's time and resources, you undoubtedly have given some thought to the postwar power-plant problems that will confront you, as it is never too early for engineering planning. B&W engineers will gladly cooperate with you to the utmost of their ability, consistent, of course, with war demands on their time.



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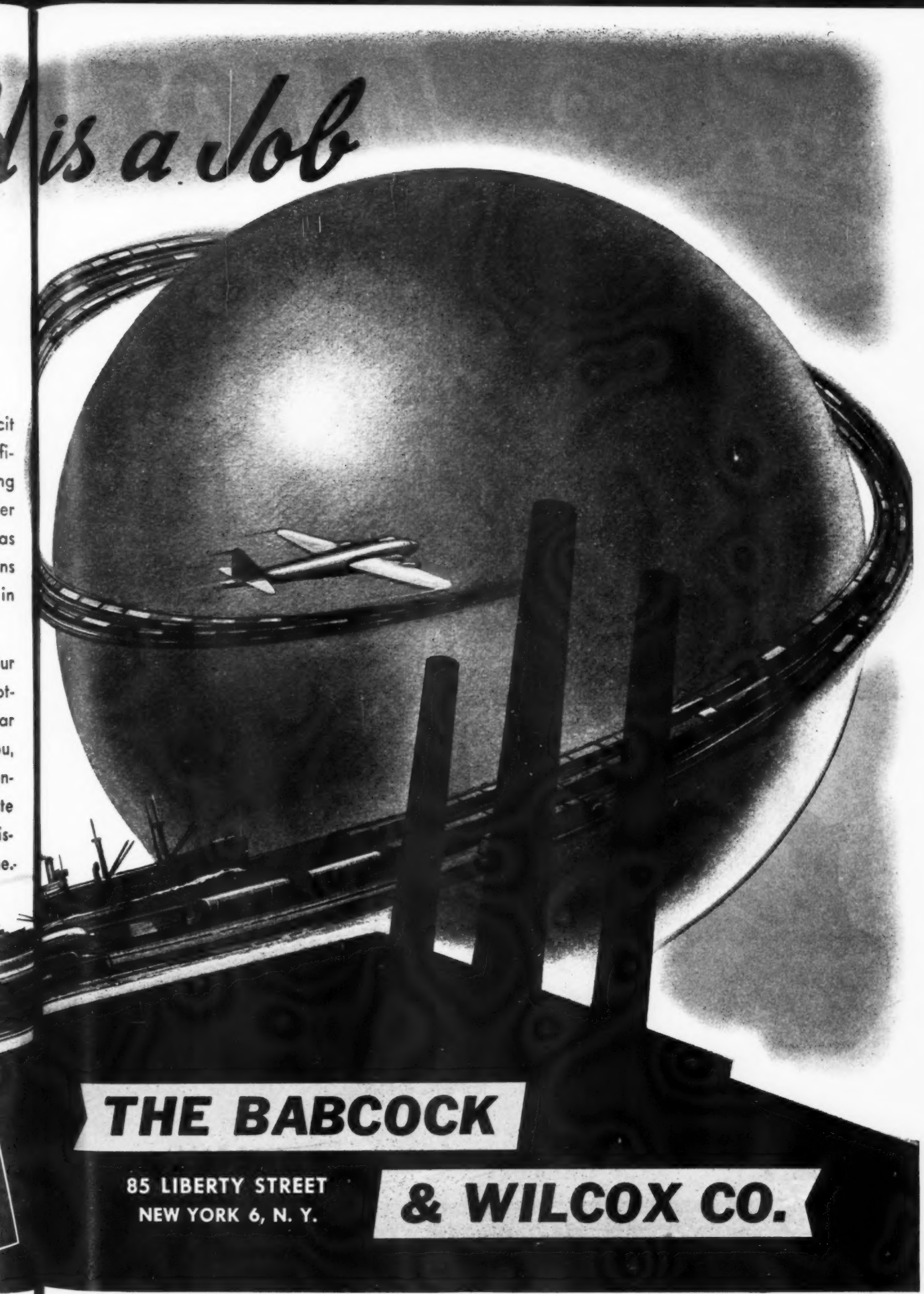
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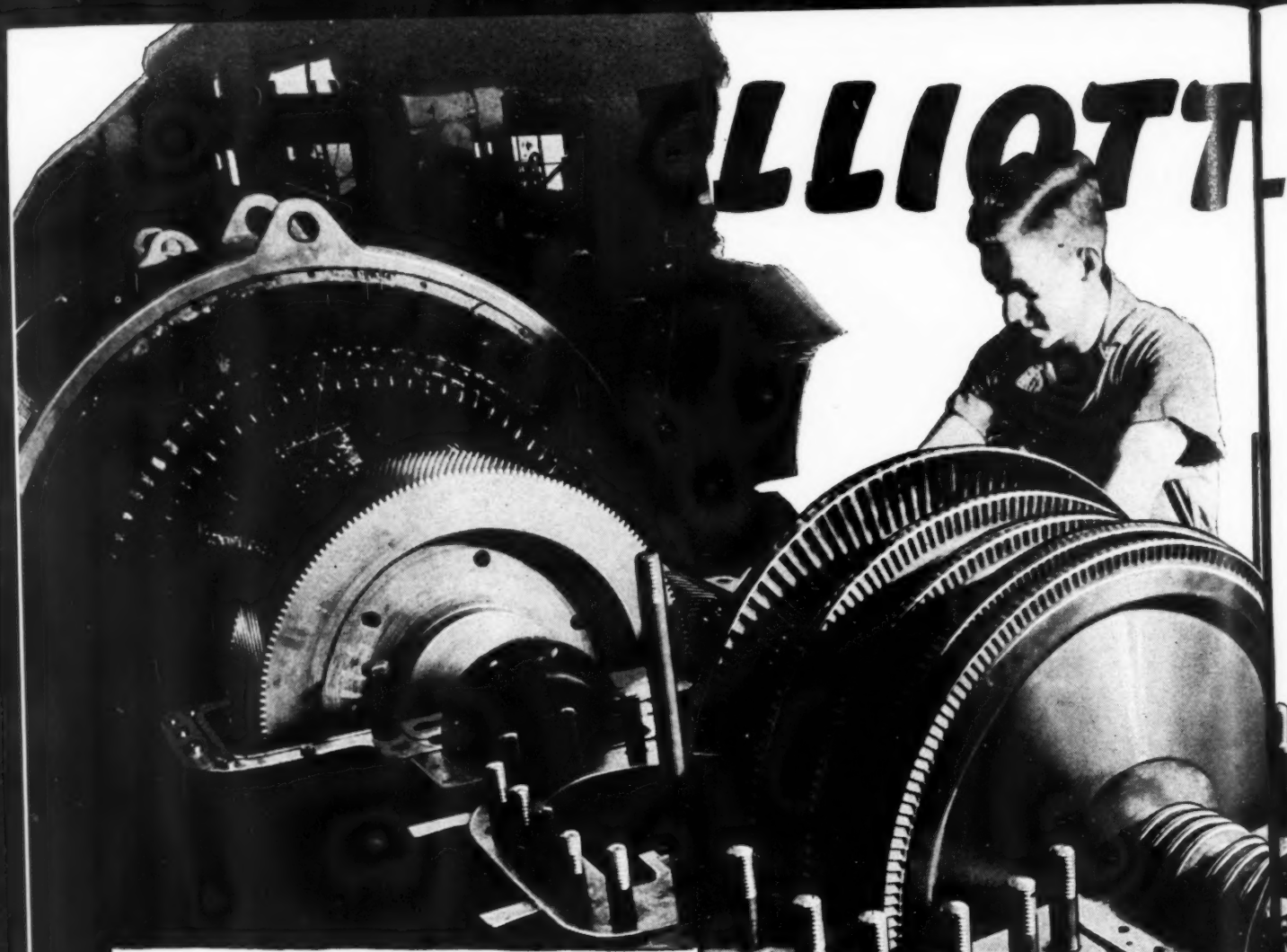
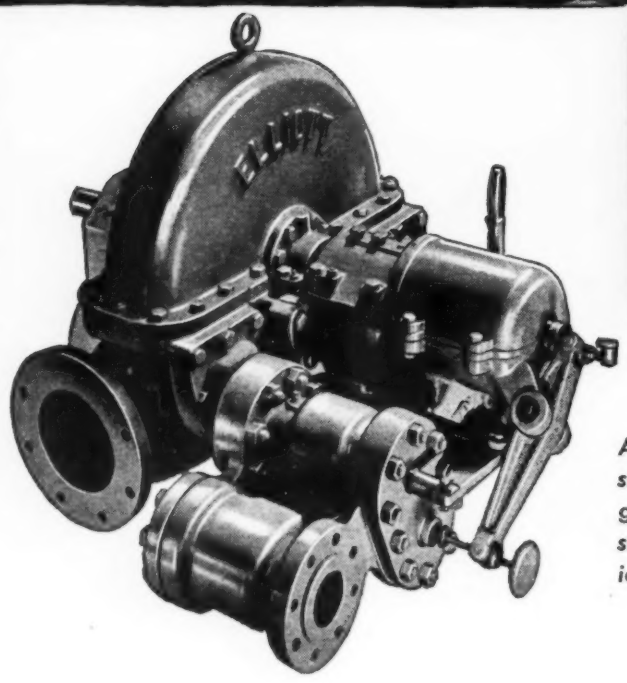




Above, an Elliott geared multi-stage turbine, as built for marine generator drive. At left, Elliott standard single-stage mechanical drive turbine

TURBINE-GENERATORS • MECHANICAL DRIVE TURBINES • ENGINES

ENGINE-GENERATORS • MOTOR-GENERATORS • MOTORS • GENERATORS

CONDENSERS • STEAM JET EJECTORS • DEAERATORS

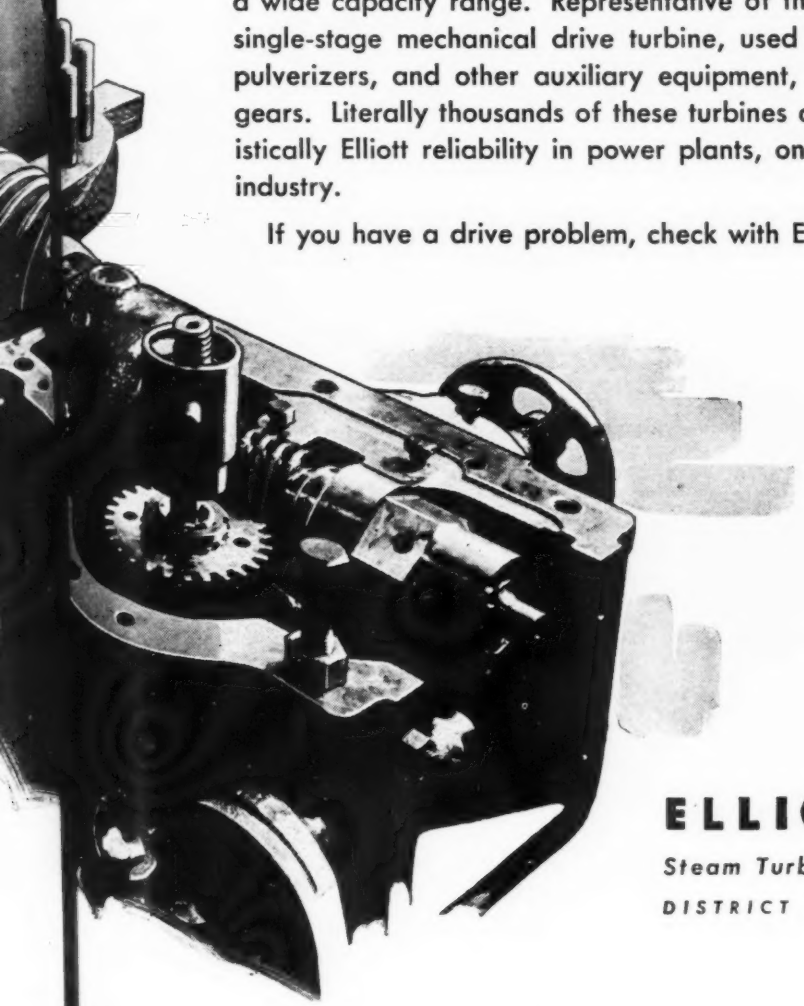
-For Turbines

STANDARD OR SPECIAL

"Tailored to the job" has become a stock phrase in speaking of Elliott steam turbines. So many of them are engineered for special conditions, such as the unit pictured at the left. This turbine is one of a large number of identical units designed for a specific wartime service. These turbines each drive three generators in line, through gears which reduce the 5600-rpm. turbine speed to a generator speed of 1200 rpm. They must pass the most rigid tests before acceptance.

The designing of special steam turbines by Elliott engineers starts from the firm foundation of a standard line of machines in several types and a wide capacity range. Representative of this standard line is the Elliott single-stage mechanical drive turbine, used with pumps, fans, blowers, pulverizers, and other auxiliary equipment, direct drive or with built-in gears. Literally thousands of these turbines are demonstrating characteristically Elliott reliability in power plants, on board ship and throughout industry.

If you have a drive problem, check with Elliott engineers.



ELLIOTT COMPANY

Steam Turbine Department, **JEANNETTE, PA.**

DISTRICT OFFICES IN PRINCIPAL CITIES

H-683

FEEDWATER HEATERS • DEAERATING HEATERS • CENTRIFUGAL BLOWERS

TURBOCHARGERS • DESUPERHEATERS • STRAINERS • SEPARATORS

GREASE EXTRACTORS • NON-RETURN VALVES • TUBE CLEANERS

How to Straighten a Warped Soot Blower Element

Soot Blower Elements—the pipe sections with nozzles within the boiler—meet such severe service conditions that they sometimes become badly distorted. Wartime difficulty in obtaining replacements quickly makes it important to know how to straighten distorted elements with minimum risk of breakage.

Diamond elements are made in three types for various temperatures:

Plain Elements—made from extra heavy seamless steel tubing with the distal ends closed by spinning. Venturi type nozzles are electrically welded into the tubing. They can be readily recognized as steel tubes.

Calorized Elements—made from extra heavy or double extra heavy seamless steel tubing with the distal end closed by spinning, and Venturi type nozzles electrically welded into the tube walls are then impregnated with aluminum both inside and outside. They can be recognized by their bright appearance.

Dialoy Elements—made from seamless chrome iron tubing having a very high percentage of chromium. The distal ends are spun closed and Venturi nozzles are formed by building up a pad of alloy on the outside of the tube and drilling the nozzle through the pad and tube wall. Dialoy elements may be recognized by these welded pad nozzles and their yellow painted distal end.

Straightening Elements—If an element is not too badly distorted and the bearings are in proper alignment, it is frequently possible to straighten the element without removing it from the boiler. This is done by turning it to the point where it binds hard in the bearings and then leaving it in this position for a few hours.

If the element is so badly distorted that this method does not straighten it, remove it from the boiler.

Heat Calorized and plain steel elements to a cherry red (about 1500° F.) and then lay on a level floor or other surface. A wooden block should then be used to tap out the bent sections. The entire element should be heated at one time if at all possible; if not, the bent sections may be heated separately.

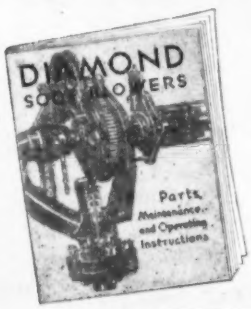
Dialoy elements should be heated to about 1650° F. (between a bright red and orange) and the same straightening process used as for Calorized and steel elements. After straightening, Dialoy elements should be quenched in water. If they cool considerably while being straightened, they should be reheated to 1650° F. and then quenched. Quenching of high chromium alloys softens or anneals the metal.

DIAMOND POWER SPECIALTY CORP., Detroit, Michigan

DIAMOND SPECIALTY LIMITED · Windsor, Ontario

Diamond Soot Blowers Have Been "Drafted"

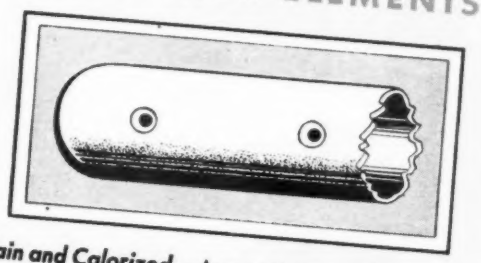
Careful Treatment Will Prolong the Life of Those You Have



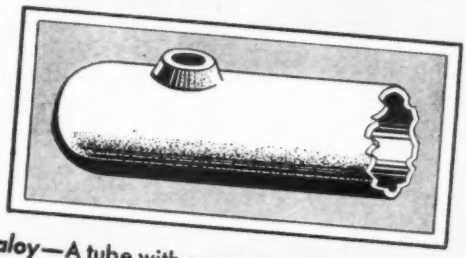
Almost the entire production of the Diamond plant is "drafted"—earmarked for war production. Hence, it is to your interest to make the soot blowers you have last as long as possible.

This is the second of a series of advertisements telling you how to do it. Send for a copy of the booklet on the care and maintenance of Diamond Soot Blowers.

THREE KINDS OF BLOWER ELEMENTS



Plain and Calorized—A smooth tube with a row of welded holes (nozzles) is either a plain or calorized element.



Dialoy—A tube with a row of pads through which nozzles are drilled is a Dialoy element.

HEAT FOR STRAIGHTENING

Heat plain and Calorized elements to 1500° F.—cherry red.

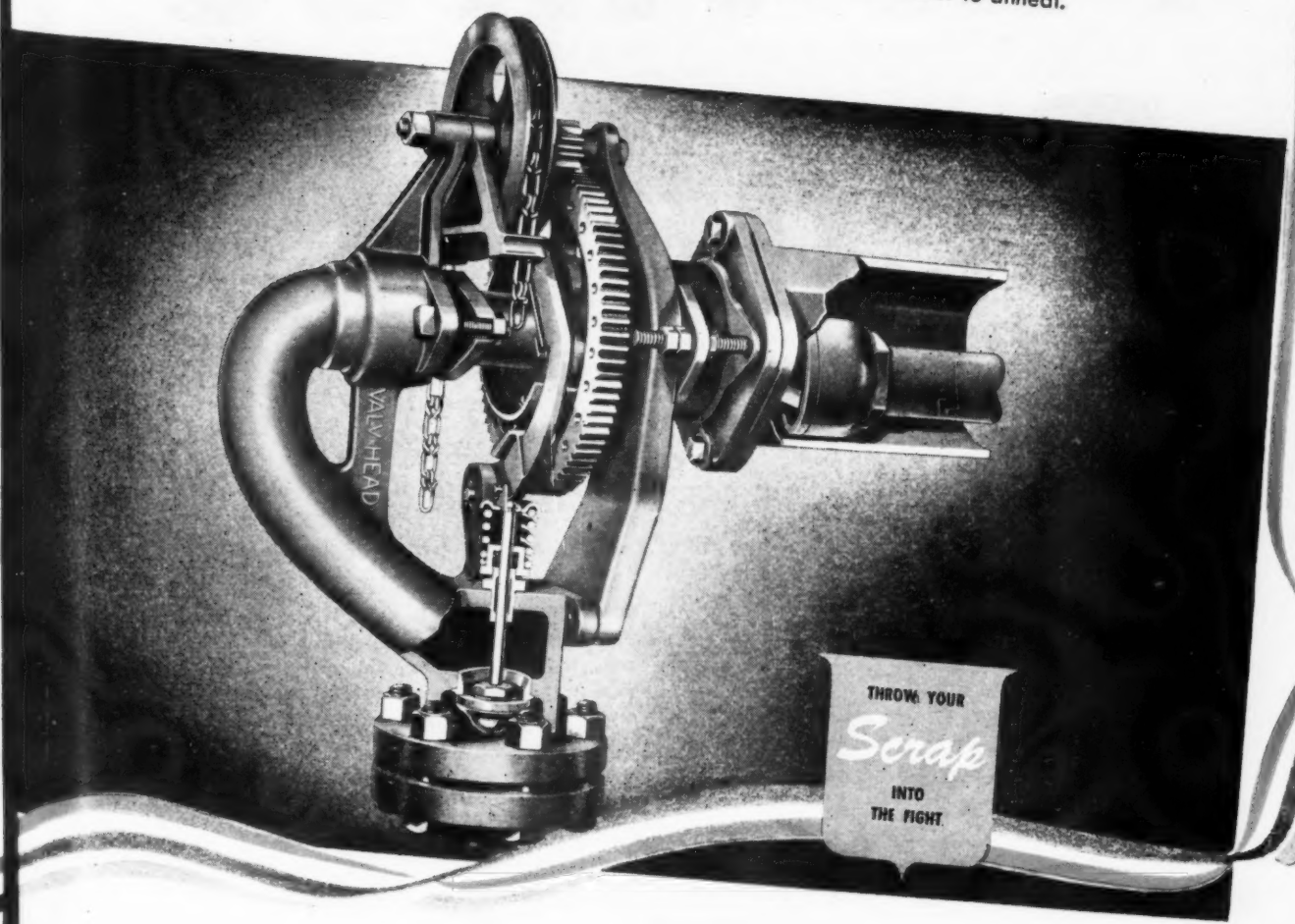
Heat Dialoy elements to 1650° F.—between bright red and orange.

ROLL ON FLAT SURFACE TO STRAIGHTEN

Tap at warped places with a wooden block. If the element cools considerably before straightening is complete, it should be reheated.

DIALOY ELEMENTS ONLY

Should be quenched in water to anneal.



NO OTHER

Gives You All Three Benefits

GARGOYLE

Lubricants

GARGOYLE D.T.E. Oil 797 was developed to meet the most severe turbine operating conditions resulting from today's increased steam pressures and temperatures. It is now in service in turbines of all sizes. Get the full details on the aristocrat of the famous Gargoyle D.T.E. line from your Socony-Vacuum representative.

SOCONY-VACUUM OIL CO., INC.—Standard Oil of N.Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. • White Eagle Div. • Wadhams Div. • Magnolia Petroleum Co. • General Petroleum Corp. of Calif.

Turbine OIL

1. A superior base stock that is in itself an excellent turbine oil.

2. Added resistance to oxidation that enables this oil to surpass all leading turbine oils in severe tests.

3. Maximum anti-rust qualities for protection against corrosion.

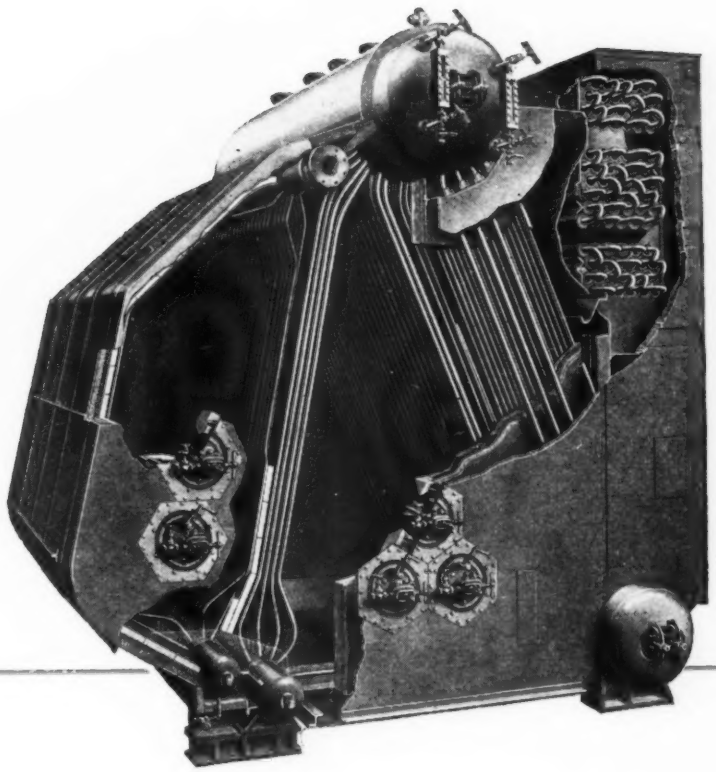
New GARGOYLE D.T.E. OIL

Highest Army and Navy

For the fifth time Foster Wheeler's Carteret Works has been awarded the Army-Navy "E" for excellence in production. Working to the exacting standards of Navy inspection, the shops are turning out unprecedented quantities of equipment.

- ★ **Steam Generators, Condensers and Distillers for the Navy, Maritime Commission and our Allies.**
- ★ **Power Plant Equipment for War Plants here and abroad.**
- ★ **Petroleum, Petro-Chemical and Chemical Plants for the U. S. and our Allies.**
- ★ **Chemical Processing Equipment for Ordnance Plants.**

FW **FOSTER**



Award to Foster Wheeler

The marine separately-fired superheater type steam generator, engineered and developed by Foster Wheeler, is standard equipment on naval combat ships. This design proved an influential factor in the development of stationary boilers incorporating the separately-fired superheater furnace principle and culminating in the Twin Furnace Steam Generator.

FOSTER WHEELER CORPORATION
165 BROADWAY • NEW YORK 6, N. Y.

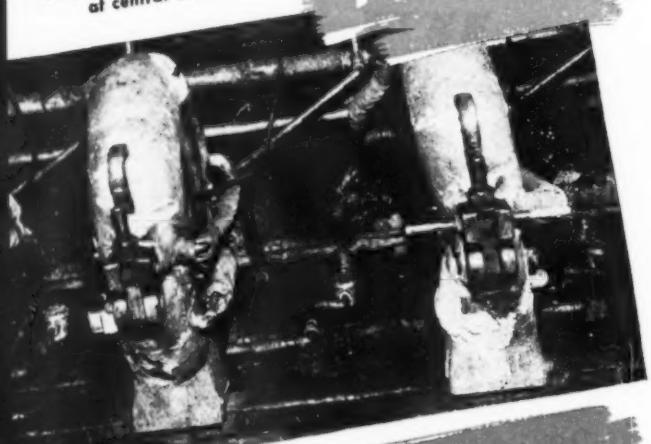
WHEELER FW

. . put it down in capital

POWER

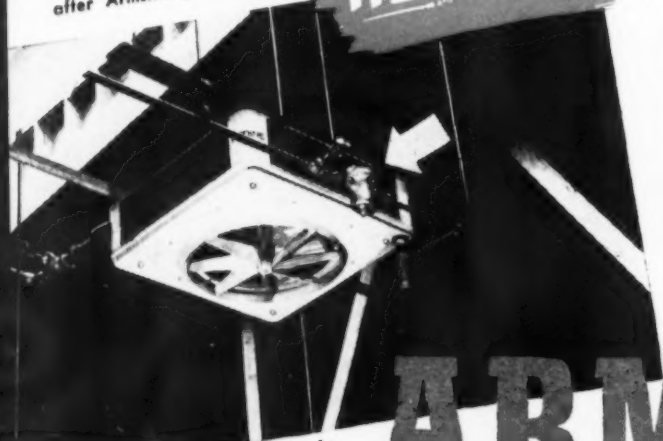
Armstrong Forged Steel Traps on 650 lb. pressure at central station.

PROCESS



30% faster heating on these Tire recapping molds after Armstrong trapping.

HEATING



Armstrong No. 812 side-inlet side-outlet trap on unit heater.

Here's What Others Have Gained From Armstrong Trapping . . .

Sixteen Armstrong Traps at Midland Chemical Laboratories, Inc., Dubuque, Iowa, saved $2500 per year on fuel and eliminated the need for an additional boiler.

* * *

British Columbia, Packers, Ltd., cut fuel cost $250 per year, more than double the cost of the Armstrong Traps installed on steam coils of settling tanks.

* * *

Northwestern Stove Equipment Corporation, Milwaukee, saved 170 tons of coal per year after installing Armstrong Traps on wood drying kilns and on the low pressure heating system.

* * *

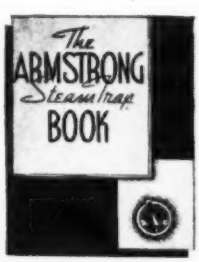
The Lord Baltimore Hotel, Baltimore, found steam savings amounted to 13% after Armstrong Trapping of laundry and kitchen equipment.

* * *

The Springfield City High School, Springfield, Ohio, reduced coal consumption 50% by installing Armstrong Traps in the heating system and one boiler was able to do the work previously requiring two.

* * *

Steam consumption on laundry presses at a plant in New Zealand was reduced 48% by installing Armstrong Traps.



Ask for
"The Steam Trap Book"

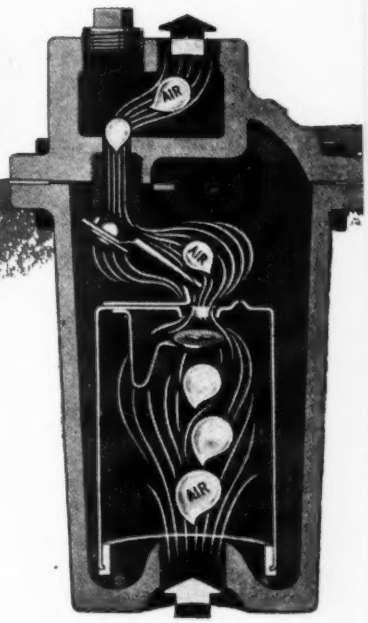
The 36 page Armstrong Catalog is full of facts, data, charts, etc., covering the application, installation, maintenance, and theory of steam traps. Includes physical data, capacities and prices on Armstrong Traps. A valuable guide for engineers and owners. Available upon request without obligation.

ARMSTRONG

letters

YOU ARE SHOVELING COAL OUT THE WINDOW

. . . if you don't have efficient trapping!



PROBABLY the biggest single source of fuel waste is inefficient trapping. This is not hard to realize when you consider that one leaky trap at 100 lbs. pressure could waste as much as 25 lbs. of steam per hour. Multiply this by the number of traps in an average plant and the figures can become staggering. In addition, steam leakage increases back pressure and reduces system capacity.

Armstrong Traps will save you these irrecoverable steam and fuel losses for the following reasons:

STEAM TIGHT VALVES. Armstrong valve parts remain steam tight for a long time. This is due to such design and construction features as:

1. Valves and seats are water-sealed at all times.
2. Valves and seats are made of chrome steel. The parts are heat treated after machining. The ball valves are precision ground. Valves and seats are lapped together. Fussy operations, but they pay in steam savings.
3. Free floating lever design lifts valve to seat without leverage, thereby minimizing wear.

AUTOMATIC AIR ELIMINATION. This saves steam in several ways:

1. No manual blowdown necessary to rid pipe or steam heated unit of air.
2. Bypass valves not needed with Armstrong Traps. A bypass valve left open accidentally or on purpose will shrink boiler capacity a lot.
3. By keeping air out of steam heated process equipment, work can be done in a shorter time, thereby reducing non-productive radiation losses.

SELF-SCRUBBING ACTION. This saves steam because:

1. It prevents accumulation of dirt which would interfere with trap operation.
2. Dirt will not lodge between valve and seat to prevent tight closing of the trap valve.

If you'd like to maintain present or higher production with less fuel consumption, let an Armstrong representative help you improve your trapping. He's an experienced sales engineer who has mastered trap selection and installation problems. He sells Armstrong Traps on a "satisfaction or your money back guarantee". Write for his name today!

TABLE A

Cost of various sized steam leaks at 100 pounds pressure (assuming steam costs 50c per 1000 lbs.)

Size of Orifice	Lb. Steam Wasted Per Month	Total Cost Per Month	Total Cost Per Year
1/2"	835,000	$417.50	$5,010.00
3/8"	470,000	235.00	2,820.00
1/4"	210,000	105.00	1,260.00
1/8"	52,500	26.25	315.00
1/16"	13,200	6.60	79.20
1/32"	3,400	1.70	20.40

(For steam at 50 pounds pressure, the waste is about 75% of the above figures; at 20 pounds, it is about 50%; and at 5 pounds, the loss is about 25%.)

TABLE B

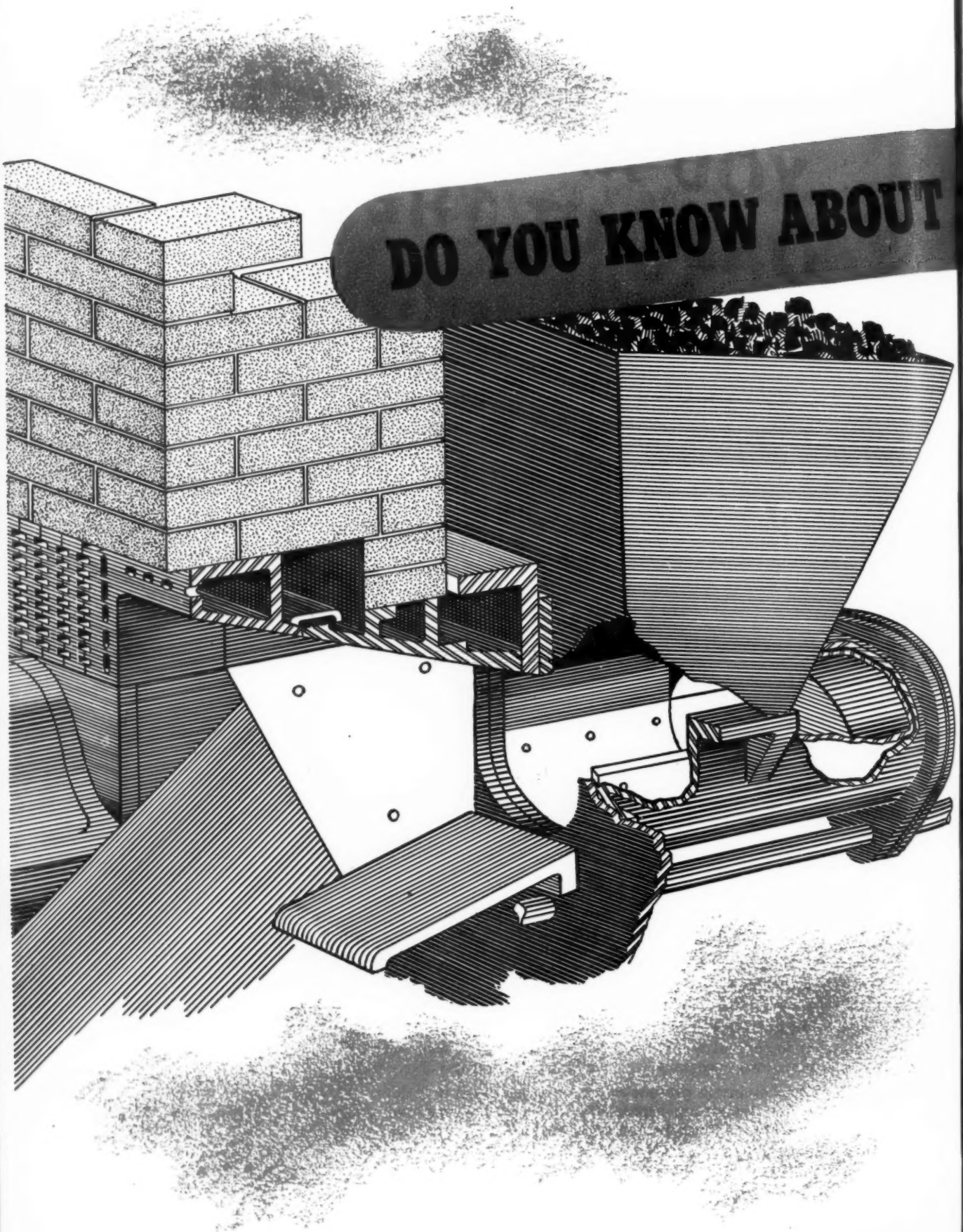
Temperature reduction caused by air at various pressures.

Gauge Pressure	Temperature of Steam with No Air Present	Temperature of Steam Mixed with Various Amounts of Air. (Per Cent Air by Volume)		
		10%	20%	30%
10.3	240.1	234.3	228.0	220.9
25.3	267.3	261.0	254.1	246.4
50.3	298.0	291.0	283.5	275.1
75.3	320.3	312.9	304.8	295.9
100.3	338.1	330.3	321.8	312.4

ARMSTRONG MACHINE WORKS
812 Maple St., Three Rivers, Michigan

ARMSTRONG · INVERTED BUCKET STEAM TRAP ·

Inverted Bucket Steam Traps


DO YOU KNOW ABOUT

THE IMPORTANT BENEFITS OF . . .

RENEWABLE LINERS AND PLATES?

THE ABRASIVE ACTION of tightly compressed coal passing through any stoker feeding mechanism subjects the ram box and throat to severe punishment.

Because of this condition, Taylor Stoker design calls for renewable liners of the ram box and renewable wearing plates of the side plate brackets. These liners and plates are comparatively small, easy-to-install sections that add to the reliability of the feeding mechanism. They also cut to a minimum the time and material cost of replacements.

Taylor renewable liners and plates, like many features of the Taylor Stoker, contribute to greater overall economy of steam generation. Such engineering once again shows the importance of experience that has been specialized on the development of stokers and that utilizes many decades of knowledge of Stoker operation.

A-E-CO TAYLOR STOKERS
LO-HED HOISTS • HELE-SHAW FLUID POWER
MARINE DECK AUXILIARIES

JUDGE THE SELECTION OF FUEL FIRING EQUIPMENT BY THESE TWELVE POINTS

1. RELIABILITY—the ability to operate with minimum outage and minimum standby equipment.

2. CAPACITY—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.

3. MAINTENANCE—the ability to operate continuously with minimum repair costs.

4. FLEXIBILITY—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.

5. EFFICIENCY—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.

6. OPERATION—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.

7. ADAPTABILITY—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.

8. FUEL FLEXIBILITY—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.

9. REFUSE DISPOSAL—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.

10. STACK DISCHARGE—the practical elimination of "smoke nuisance" without special equipment.

11. SPACE REQUIREMENTS—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.

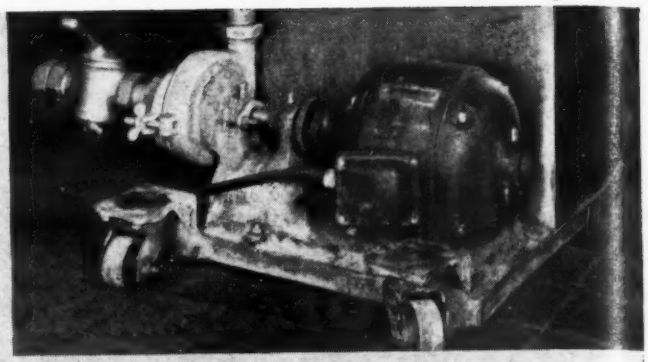
12. OBSOLESCENCE—the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

A-E-CO TAYLOR STOKER

AMERICAN ENGINEERING COMPANY

PHILADELPHIA 25 • PENNSYLVANIA

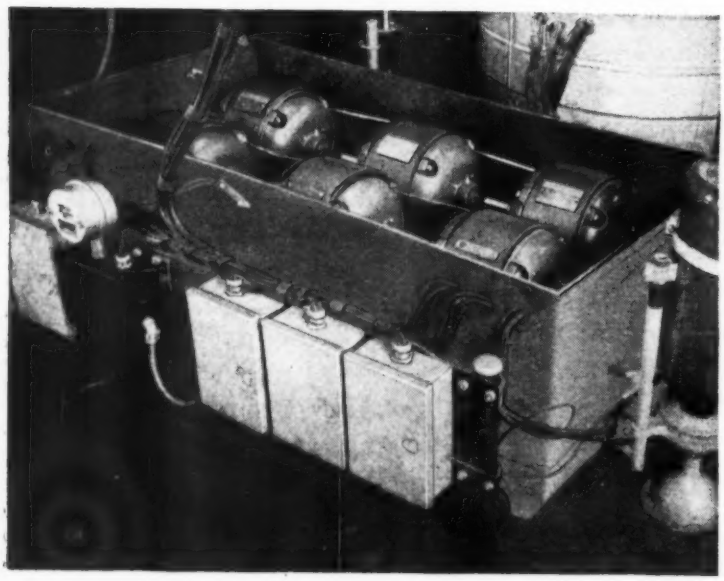
DOUSED DAILY!



G-E Tri-Clad motor coupled to a centrifugal pump on a portable cleaner in the milk plant of H. P. Hood & Sons, Inc., Charlestown, Mass.

POWERING A DAIRY PUMP, this Tri-Clad splashproof motor gets a dousing every day as the plant is hosed down. After years of service, frame and end shields are virtually uncorroded, insulation is going strong. G-E "protection tests", both in the development of the Tri-Clad design and in our daily production, help us assure you of long-lasting service from Tri-Clads on motor-wracking jobs like this.

"Hot Box" at 100% humidity tests TRI CLAD motor protection



Here is one of the many development tests which helped to prove the *extra* stamina engineered into the Tri-Clad design. In the bottom of this moisture box, just below the motor base, two inches of water was maintained at 212 F. The cover kept the humidity within the box at 100 per cent. By operating motors in this atmosphere to the breakdown point, G. E. got the low-down on the coil insulation's moisture resistance. Tri-Clad motors, in both open and splashproof construction, showed up unusually well in this extra-severe test. *General Electric Company, Schenectady, N. Y.*

GENERAL ELECTRIC

Every week more than 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.

[PUMP TIPS FROM ALLIS-CHALMERS—ONE IN A SERIES]

How to make WEARING RINGS Last Longer . . .

ANY NEW PUMP you buy is guaranteed to deliver its rating in capacity and head. But whether it *retains* its actual capacity depends to a great extent on the condition of its wearing rings. For when rings are worn thin, liquid leaks through the enlarged clearance between impeller and casing — seriously reducing capacity.

One of the major causes of excessive ring wear is misalignment. So serious can it be, that Allis-Chalmers engineers were led to develop, for many applications, the "Electrifugal" pump — in which *both* impeller and motor are mounted on *one* shaft and in *one* frame. This *unit-design* prevents parts in the pump's closely fitted body from getting out of "kilter" . . . helps you get longer life out of wearing rings.

However, regardless of whether you have a unit-design or separately coupled pump and motor, here are a few tips which will help you get longer wear from rings in your pumps . . .

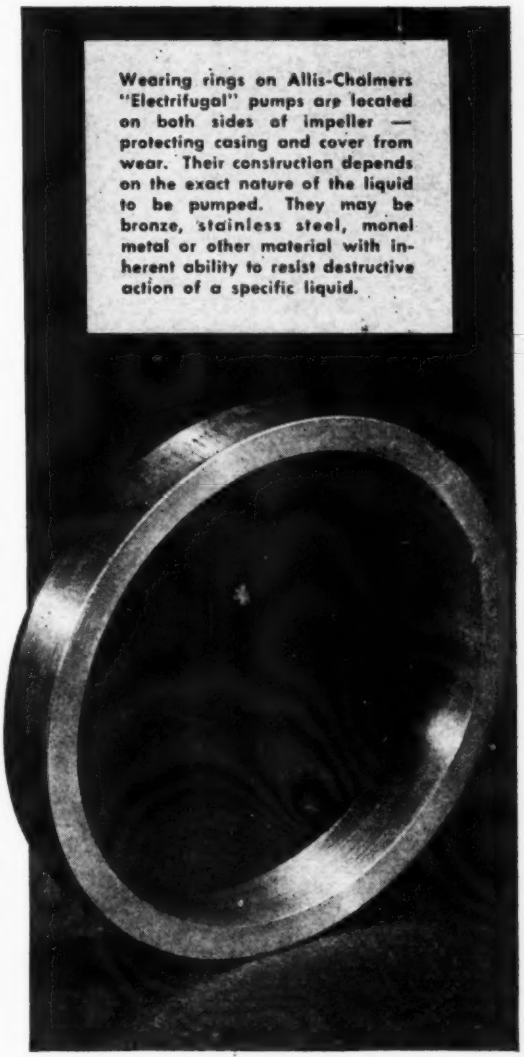
▸Never allow a pump to run dry — either through lack of proper priming when starting, or through loss of suction when operating. Remember . . . water is a *lubricant* between rings and casing.

▸Examine wearing rings at regular intervals. When new, rings in the smaller size, more commonly used pumps should have a diametrical clearance of about 0.006 to 0.008 inch on cold liquid service, and about 0.010 to 0.012 on hot liquid service. When ring clearance becomes 0.020 to 0.030 inch on the diameter it is more economical to replace rings than to pay for power lost in leakage through them.

▸Gritty liquid or foreign matter in liquid accelerates ring wear. If condition exists, provide intake end of suction piping with a suitable screen to filter out abrasive materials.

▸Watch pump alignment. Excessive strains from suction or discharge piping can and do distort casing. Wearing rings protect pump from serious damage in this event by themselves taking the wear. However, *before* installing new rings, be sure to check into the *source* of distortion.

▸Send for your *free* copy of "Handbook for Wartime Care of Centrifugal Pumps". This valuable booklet applies to *all* makes of pumps; contains *no* advertising. Contents include: tables of friction losses; guide to locating trouble; wartime maintenance schedule. ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WISCONSIN. A 1756

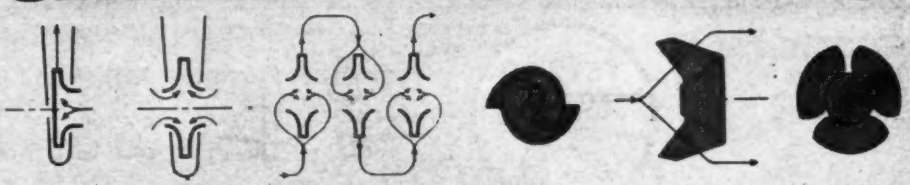


Wearing rings on Allis-Chalmers "Electrifugal" pumps are located on both sides of impeller — protecting casing and cover from wear. Their construction depends on the exact nature of the liquid to be pumped. They may be bronze, stainless steel, monel metal or other material with inherent ability to resist destructive action of a specific liquid.

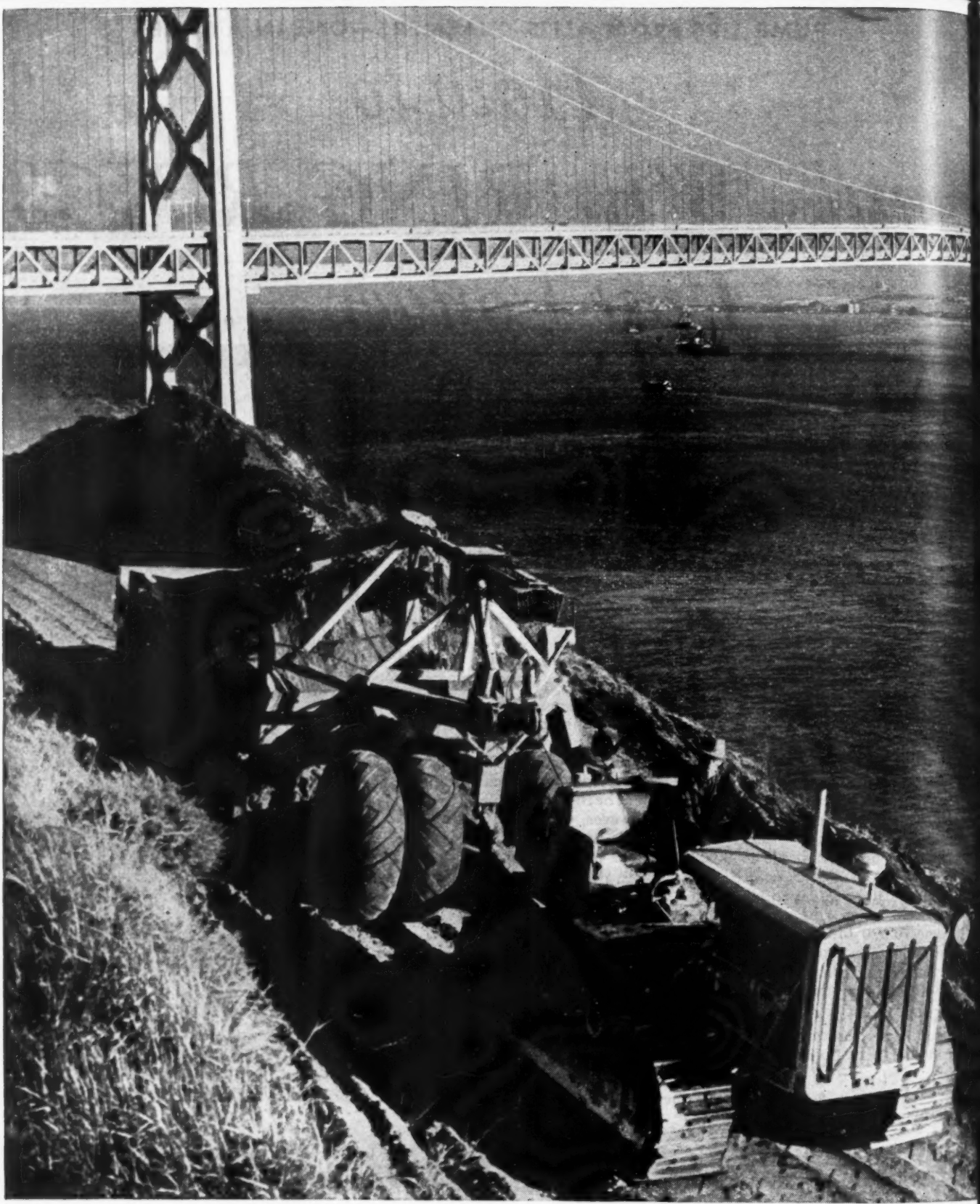
♪ *Tune in the Boston Symphony, Blue Network, every Saturday at 8:30 pm, EWT.*

ALLIS-CHALMERS PUMPS

Allis-Chalmers builds all types and variations of pumps shown at right. Capacities from 10 to 150,000 gpm—heads to 2500 lbs.



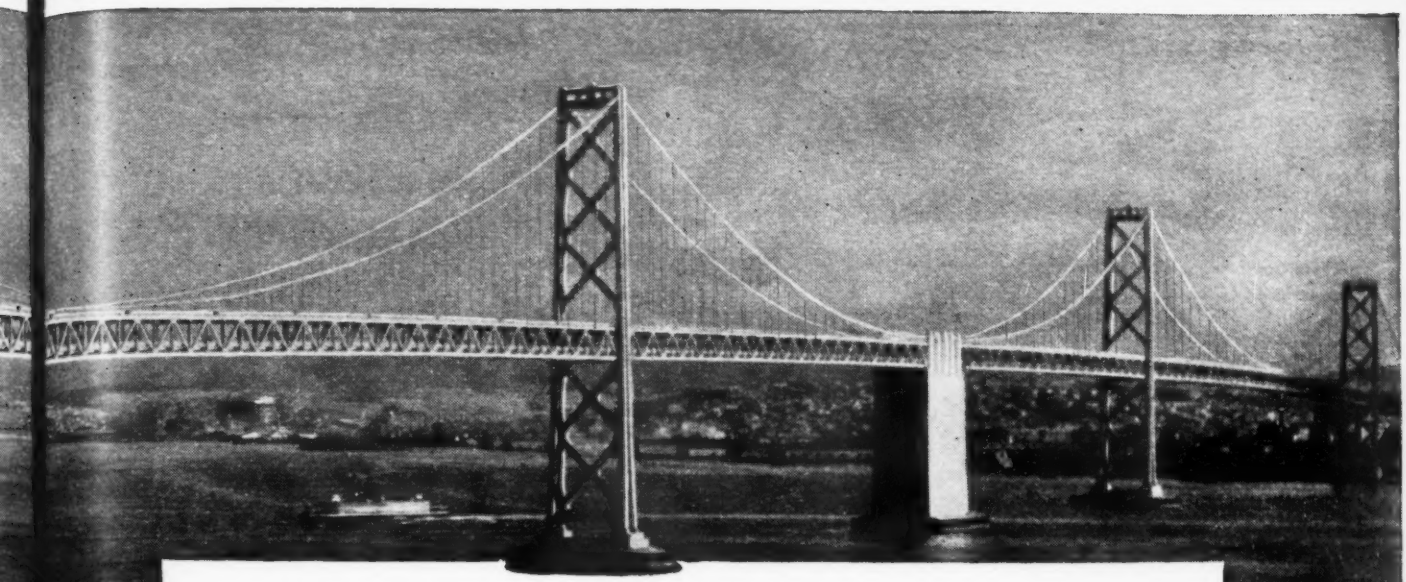
Single Suction | Double Suction | Double Suction Multi-Stage | Open Impeller | Mixed Flow | Axial Flow (Propeller)



TEXACO

TEXACO

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT — CBS



WONDER WORKERS

WHETHER excavating for great suspension bridges, building highways or furnishing power in thousands of plants . . . one of the most adaptable power units is the Diesel.

Irrespective of size or speed the vital need of your Diesels is effective lubrication . . . Texaco Ursa Diesel lubricants.

Texaco Ursa Diesel lubricants encompass a complete line of oils that prevent scuffing, thereby increasing life of rings, pistons and liners. They keep rings free in their grooves, valves active, ports clear, assuring full piston seal that means maximum economy, and longer periods between overhauls. They also protect modern alloy bearings. Because of these benefits—

More stationary Diesel hp. in the U. S. is lubricated with Texaco than with any other brand.

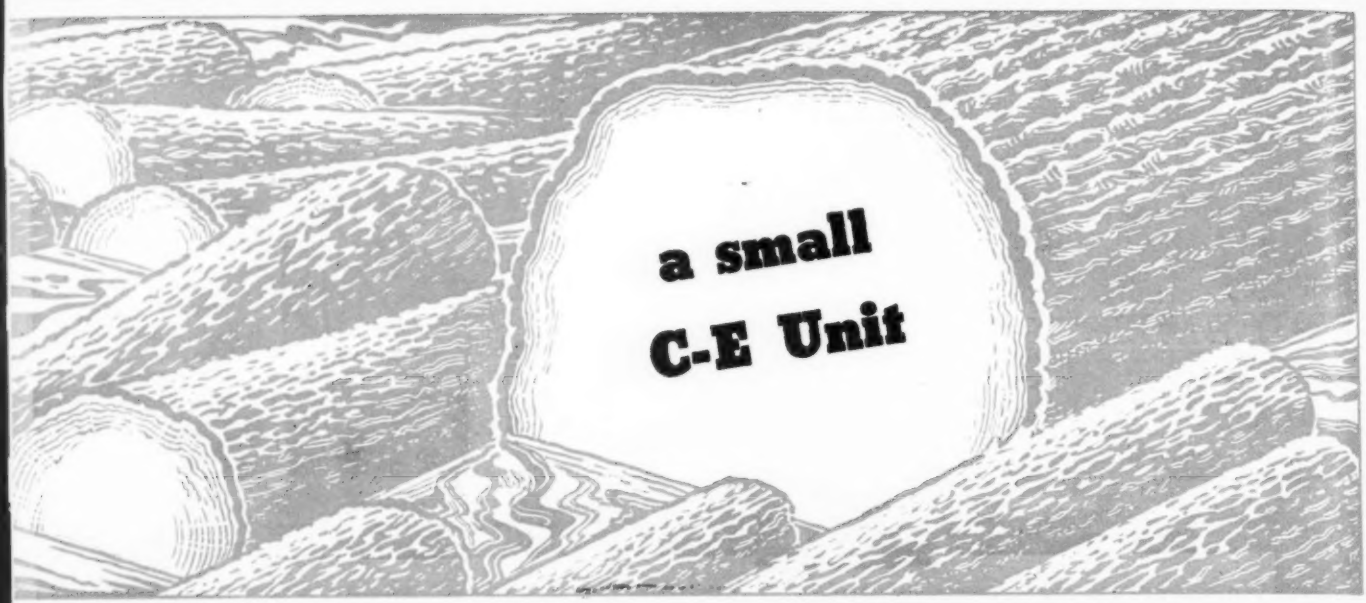
A Texaco Lubrication Engineer, specializing in Diesel engine lubrication, will gladly recommend the most suitable type and grade of *Texaco Ursa Oil* for your engines. Phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

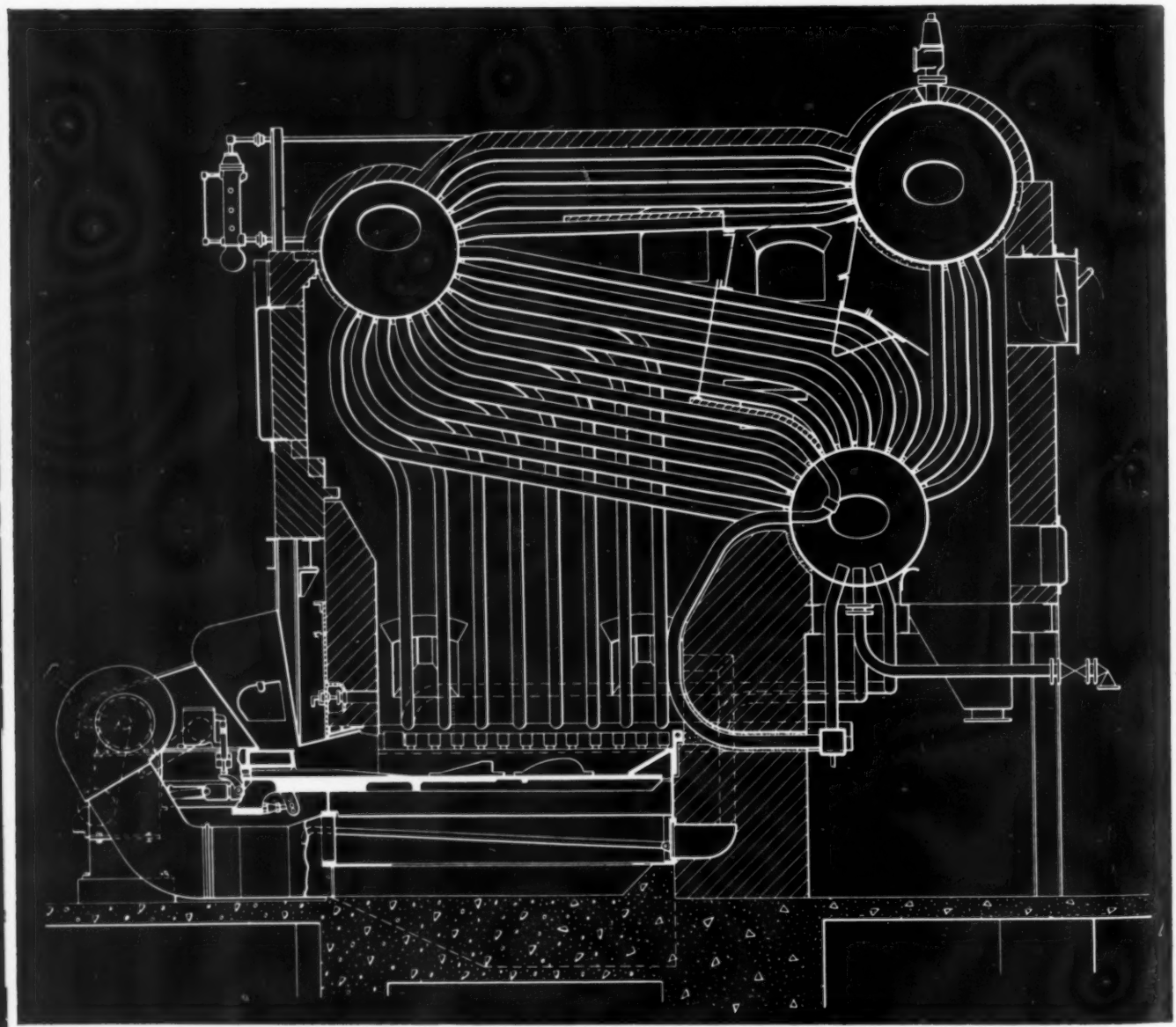
The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Lubricants and Fuels

FOR ALL DIESEL ENGINES

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY





Shown above is the C-E Unit responsible for the record on the opposite page. It comprises a C-E Bent Tube Boiler, Type VM, equipped with water-cooled side and rear walls and fired by a C-E Underfeed Stoker, Type E. Capacity 10,000 lb of steam per hr; Design Pressure — 160 psi.

IN 1940 a prominent pulp and paper company was advised by its insurance company that its old Heine boiler, built back in 1892, was about ready for retirement. The boiler was still in good condition and could have continued to operate at reduced pressures. But wartime demands were heavy and it seemed wise to retire the veteran with honor and install a new unit.

Naturally this manufacturer came to Combustion Engineering, of which the Heine Boiler Company has long been a part, for the new equipment. It was decided to install a C-E Bent Tube Boiler, Type VM, fired by a C-E Underfeed Stoker, Type E. The arrangement of this unit is shown at the left.

A recent report on this equipment reads, "This unit runs 24 hours a day and is only taken off the line every six months. Even then the longest period out of service has been 18 hours. The response of this equipment to steam demand may be judged from the fact that the pressure never drops more than 5 pounds, despite the fact that the principal load is digesters, which really *pull* steam out of a boiler."

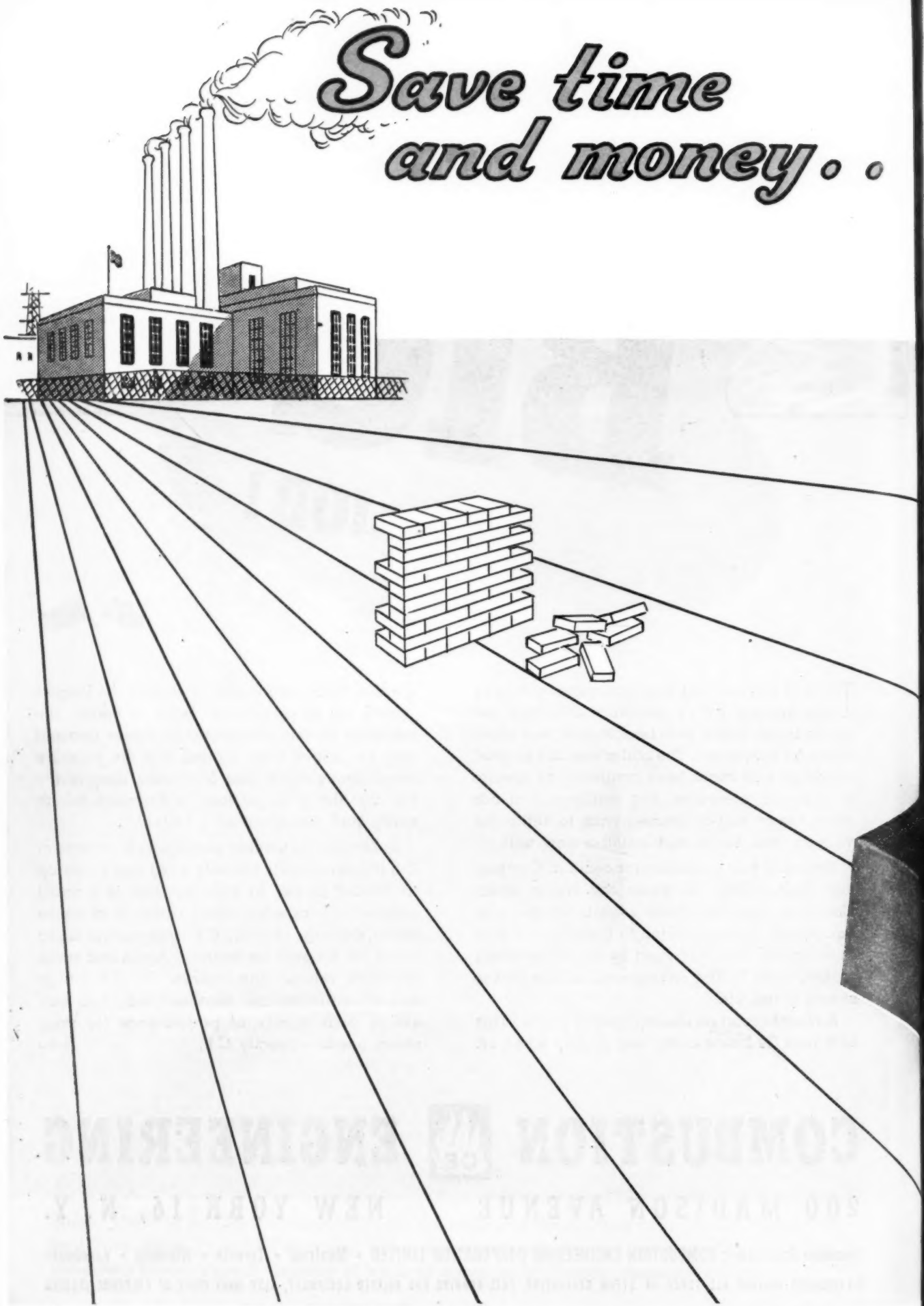
In contrast to notable performance records of C-E industrial units recently cited that range up to 150,000 lb per hr capacity, this is a small installation – capacity about 10,000 lb of steam per hr. But large or small, C-E equipment is doing a real job all over the country. Again and again the extra values – the reserve – in C-E design and construction are demonstrated. You can assure such quality of performance for your steam needs – Specify C-E. A-800

COMBUSTION C-E ENGINEERING

200 MADISON AVENUE NEW YORK 16, N. Y.

Canadian Associates: COMBUSTION ENGINEERING CORPORATION LIMITED • Montreal • Toronto • Winnipeg • Vancouver

C-E PRODUCTS INCLUDE ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; ALSO MANY TYPES OF PRESSURE VESSELS


Save time
and money . .

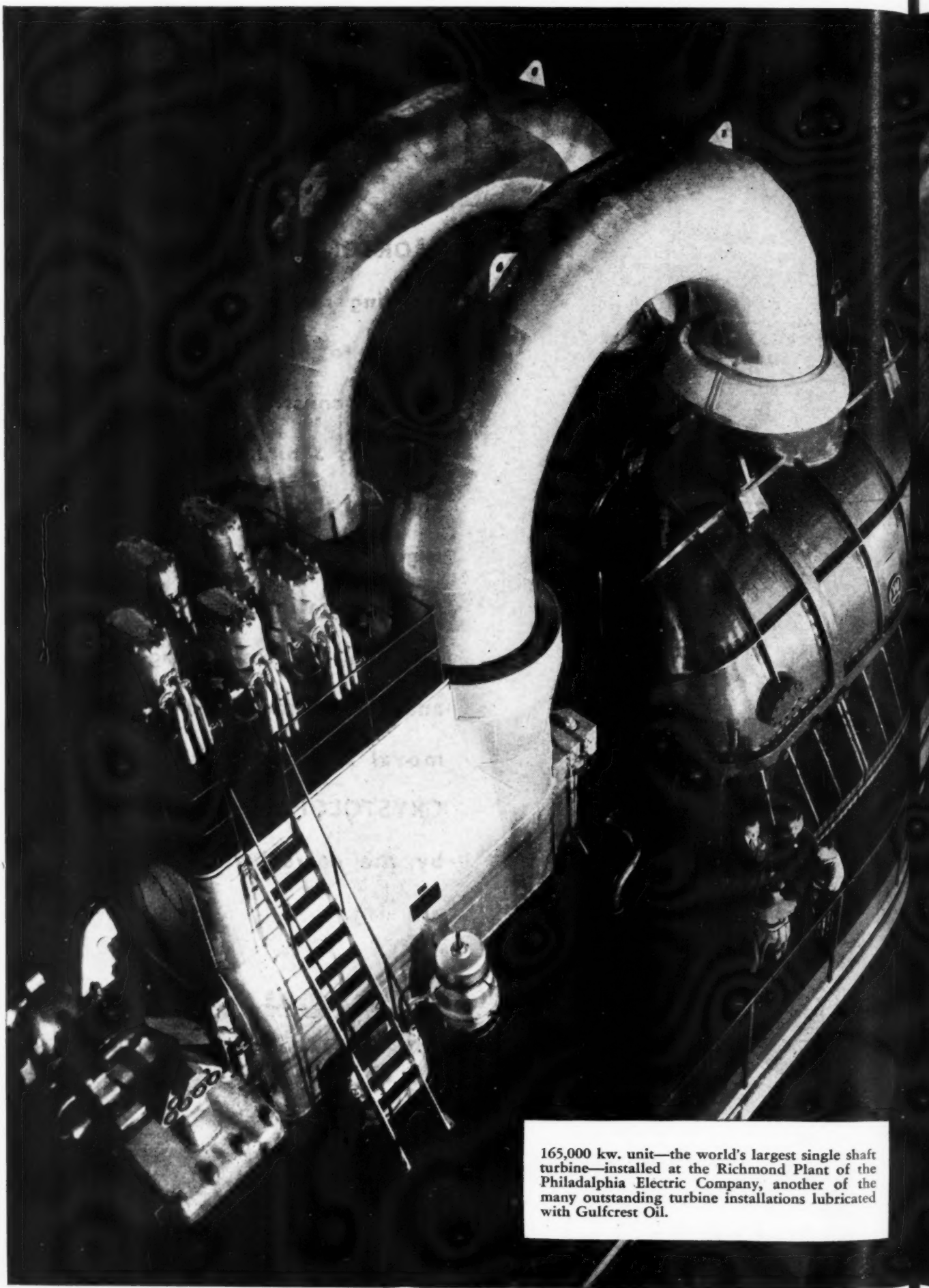
. . . with CRYSTOLON brick

NORTON CRYSTOLON Brick are bringing real savings in time and money to power plant operators. Densely constructed of silicon carbide plus a highly refractory bond and fired at high temperatures these rugged brick will not spall under peak operating conditions. Their dense surface resists slag adhesion and penetration making clinker removal a short, easy operation. CRYSTOLON Brick are unaffected by the corrosive action of coal ash slag.

R-872

NORTON COMPANY
WORCESTER 6, MASSACHUSETTS

Norton Longer Lasting Refractories



165,000 kw. unit—the world's largest single shaft turbine—installed at the Richmond Plant of the Philadalphia Electric Company, another of the many outstanding turbine installations lubricated with Gulfcrest Oil.

WORLD'S LARGEST SINGLE SHAFT TURBINE

makes outstanding record

with Gulfcrest Oil

50,000 HOURS with no evidence of deterioration, and very little make-up—that's the service record of Gulfcrest Oil in this 165,000 kw. turbine installed at the Richmond Plant of the Philadelphia Electric Company, Philadelphia, Pa.

Here's the important reason for the outstanding performance of Gulfcrest Oil in the turbine systems of hundreds of leading power plants throughout the country: More thorough and more complete refining! For in addition to conventional refining methods, Gulfcrest Oil is super-refined by the Gulf Alchlor Process, the most effective method for producing a turbine oil with maximum resistance to oxidation and sludge. Gulfcrest Oil is the world's finest turbine lubricant!

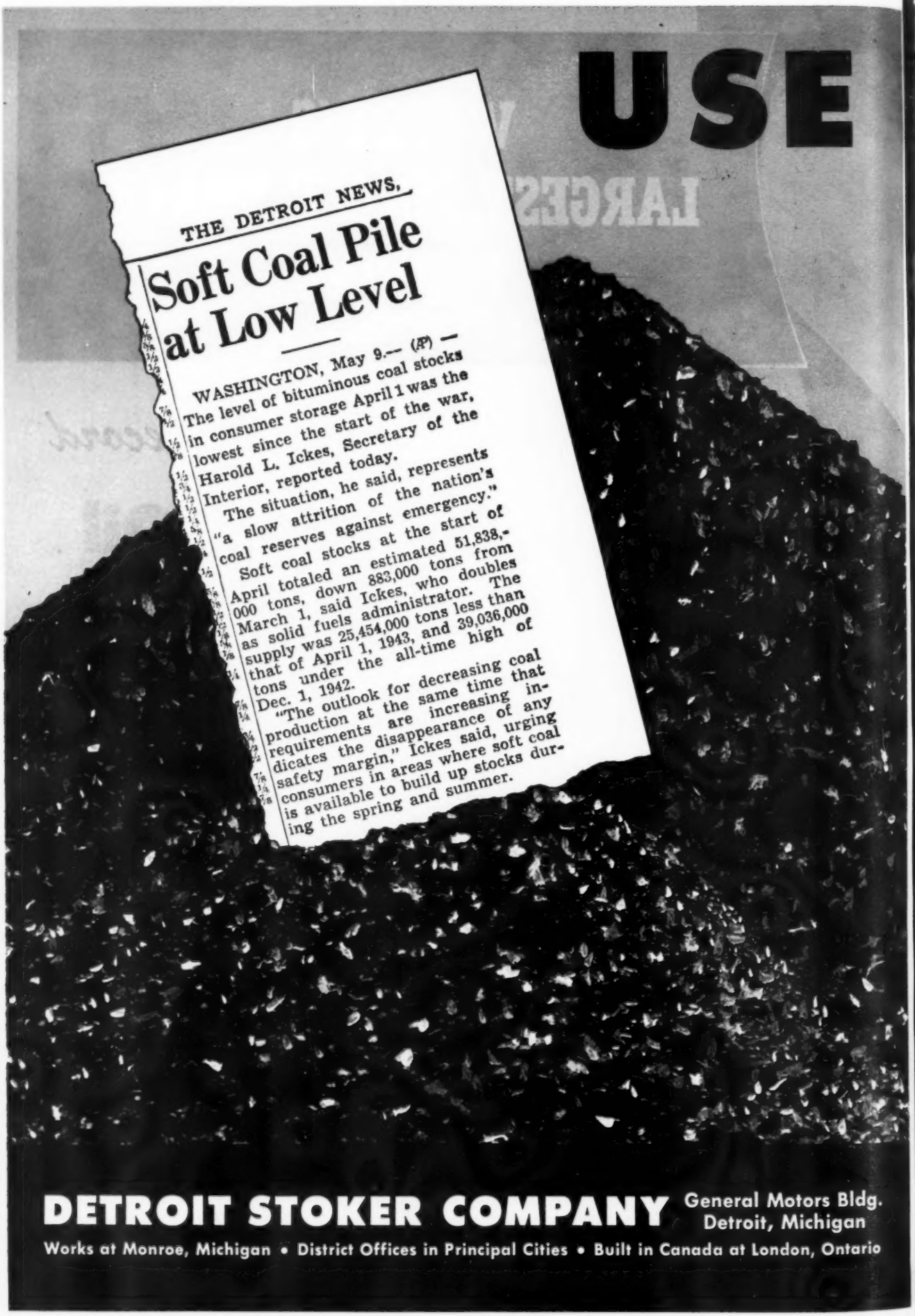
Call in a Gulf Lubrication Service Engineer and ask him to show you how Gulfcrest Oil can help you get improved lubrication and higher operating efficiency for your turbines. Write, wire, or phone your nearest Gulf office today.

Gulf Oil Corporation · Gulf Refining Company

Gulf Building, Pittsburgh 30, Pa.

GULF INDUSTRIAL LUBRICATION

Back the Attack... Buy More War Bonds!


USE
THE DETROIT NEWS,
Soft Coal Pile at Low Level
WASHINGTON, May 9.— (AP) —
The level of bituminous coal stocks in consumer storage April 1 was the lowest since the start of the war, Harold L. Ickes, Secretary of the Interior, reported today.
The situation, he said, represents "a slow attrition of the nation's coal reserves against emergency."
Soft coal stocks at the start of April totaled an estimated 51,838,000 tons, down 883,000 tons from March 1, said Ickes, who doubles as solid fuels administrator. The supply was 25,454,000 tons less than that of April 1, 1943, and 39,036,000 tons under the all-time high of Dec. 1, 1942.
"The outlook for decreasing coal production at the same time that requirements are increasing indicates the disappearance of any safety margin," Ickes said, urging consumers in areas where soft coal is available to build up stocks during the spring and summer.
DETROIT STOKER COMPANY
General Motors Bldg.
Detroit, Michigan
Works at Monroe, Michigan • District Offices in Principal Cities • Built in Canada at London, Ontario

LESS COAL

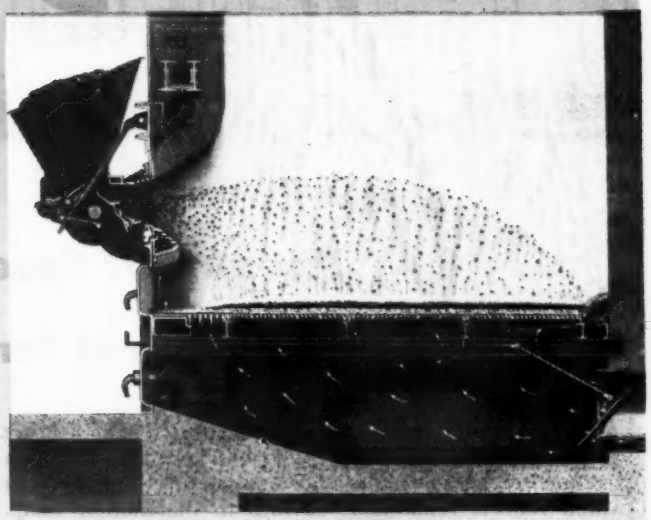
DETROIT STOKERS

- **burn a wide variety of coals —make substantial savings**

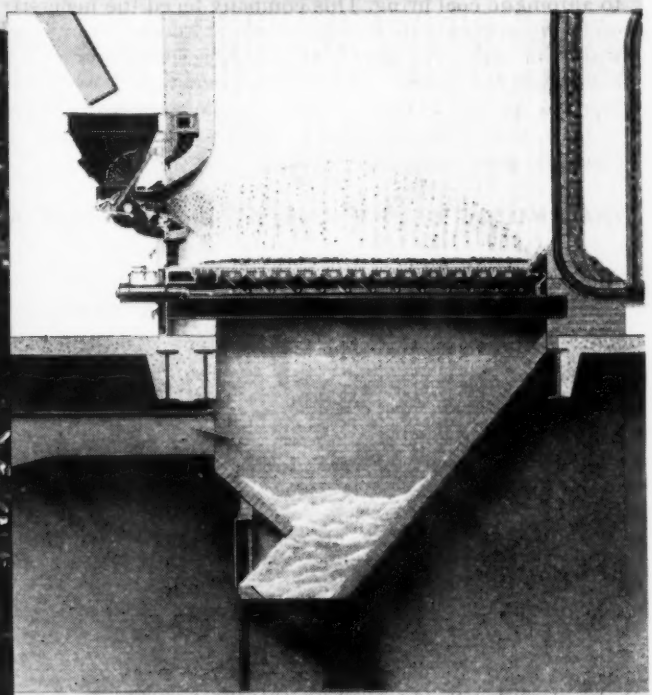
The Nation's coal stocks are low —lowest since the beginning of the war, according to the Department of the Interior. Coal men estimate that the Nation must burn much less coal next winter.

Detroit Stokers make substantial savings, particularly on fluctuating loads. They permit a wide choice of fuel—important if transportation difficulties make it necessary to change coal frequently.

Detroit Stokers require no special fuel preparation. Write for literature.



Detroit RotoStoker (Stationary Grate Type) for medium boilers. OVERTHROW ROTOR ACTION assures uniform fuel distribution.



Detroit RotoStoker (Power Dumping Grate Type) for larger boilers. Burn fine particles of fuel in suspension—coarse coal on grates.

Iron Fireman

Tough Firing

for instance:

Pneumatic Spreader Stokers Lift Coal 32 ft.—

Save $25,000 First Cost for Hunt-Rankin Leather Compa

BECAUSE it operates on the basic principle of floating coal to the fire on a stream of air, the Iron Fireman Pneumatic Spreader stoker has a flexibility of application which reflects remarkable savings in installation costs. These installation cost savings are a plus economy over and above, and in addition to, the widely heralded savings from operation.

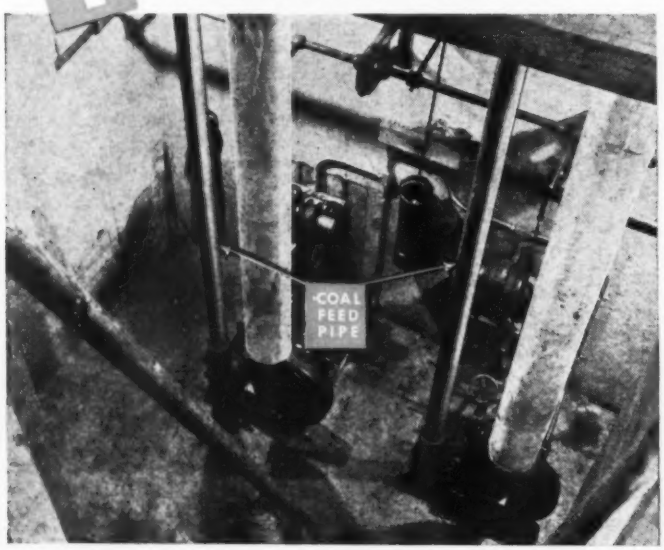
At the Hunt-Rankin Leather Company plant, Peabody, Mass., the job was to convert a plant designed for oil to automatic coal firing. This company faced the necessity of conveying coal to a boiler room at second floor level with the only available coal storage space about 400 feet from the power house. It appeared that overhead bunkers and an extensive conveying system would have to be installed. Iron Fireman found a simple method of obviating this.

Pneumatic Spreader Flexibility Proves Solution

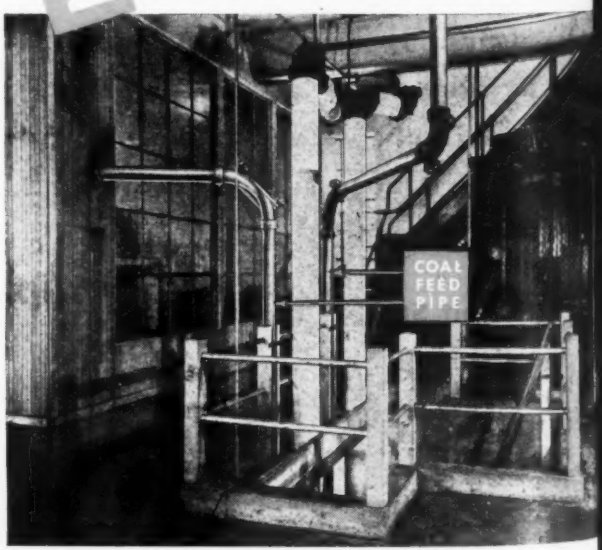
Mr. G. J. Harrington, president of the company, workin with Iron Fireman engineers—found the answer in Iro Fireman Pneumatic Spreader stokers, thereby saving a estimated $25,000 in installation costs. Iron Firema Pneumatic Spreader stokers provide efficient conveyi of coal without the expense of installing auxiliary co handling equipment. They can be set at floor level, the floor above or below the boiler room level, and any angle in relation to the boiler front. As shown the illustrations, in the Hunt-Rankin plant coal is lift by two bunker-feed stokers from a storage pit, excavate below the first floor level, to the boiler room on th second floor; a vertical distance alone of 32 feet.

THE PHOTOS BELOW AND AT RIGHT SHOW ACTUAL INSTALLATION AT HUNT-RANKIN COMPAN

1 **Coal is fed automatically from storage pit into pneumatic conveying pipes.**

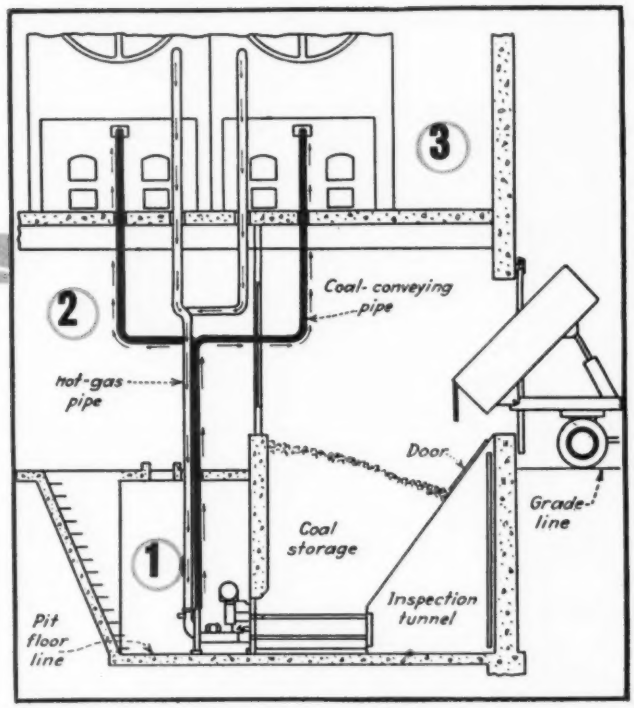


2 **Coal feed pipes lift coal vertically 32 feet to boiler room level.**



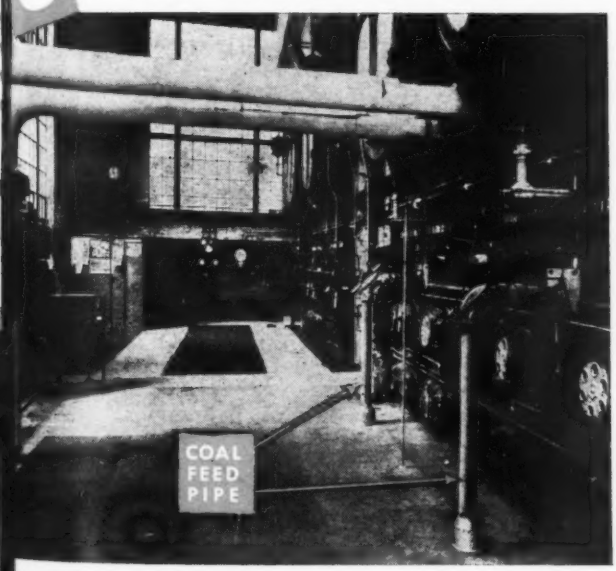
Stokers Handle Jobs . . .

73% Boiler Efficiency; Peak Ratings Up to 195% of Normal. Operating 24 hours a day, two boilers carry the normal load at the Hunt-Rankin plant, leaving two in reserve. Operation of these Iron Fireman Pneumatic Spreader stoker fired units shows an overall efficiency of 73% with 13.5% CO_2, and 530-F exit-gas temperature. At operating pressure of 175 psi gage, the evaporation averages 10.8 lb. per lb. of coal. Fuel used is 1¼ in. Pocahontas nut and slack, showing 14,500 Btu per lb. on analysis. The Hunt-Rankin boiler plant has a steam flow varying from Normal to 195% of boiler rating. Despite these severe fluctuations in load, automatic controls maintain desired pressure within close limits.



This diagram of the Hunt-Rankin installation illustrates the great flexibility of Iron Fireman Pneumatic Spreader stokers. Here, with coal storage in a pit accessible from grade level, hot-gas and coal conveying pipes lift from feed screws and transfer housings at pit level to boilers on second-floor, a distance of 32 feet. Numbers on diagram correspond to numbered photographs.

3 **Coal is distributed over grates by stoker nozzle on coal feed pipes. Note uncluttered boiler front.**



There is an Iron Fireman for Every Industrial Firing Need

To meet the most varied industrial firing requirements, Iron Fireman stokers are available in many sizes and models, including both underfeed and pneumatic spreader types and hopper and bunker-feed models. Iron Fireman engineering assures you the correct stokers for *your* plant, taking into account fuel, load and operating conditions. Our nationwide organization of qualified factory representatives and dealers is at your service. Write for literature. Iron Fireman Manufacturing Co., 3272 West 106th St., Cleveland 11, Ohio.

OUR CATALOG IS FILED IN SWEET'S

IRON FIREMAN
Automatic Coal Stokers

* Extreme

TIDE WATER LUBRICANIA

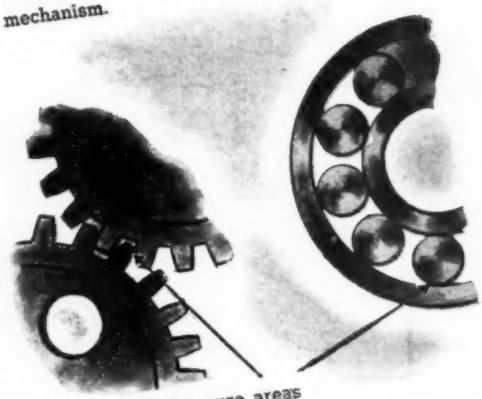
DEFINITION: Extreme Pressure Lubricants are mineral oils or greases compounded with certain additives, which give the lubricants the property of "greatly increased load-carrying ability." (The slight increase in load-carrying ability which occurs when fatty oils are added to mineral oils is not sufficient to justify such products being termed Extreme Pressure Lubricants.)

EXPLANATION: Mechanisms such as gears, anti-friction bearings operate with both a rolling and rubbing action. The areas of contact between the gear teeth, or in the case of the anti-friction bearings, between the rolls or balls and their races, are extremely small, hence unit pressures may become very great, often in the region of four or five hundred thousand pounds per square inch. Under these conditions of loading, and as rubbing velocities increase, mineral oils regardless of viscosity are unable to maintain an unbroken fluid film of oil between the relatively moving parts. The metals in contact each being made of steel are not in themselves good bearing surfaces. The result is that when metal to metal contact occurs, high local temperatures develop, resulting in incipient welding of the metal parts in contact. As motion continues, they tear apart resulting in scored surfaces on the gear teeth, rolls, balls or races.

By adding certain compounds to the oil (usually compounds containing sulphur, chlorine or phosphorus), an "Extreme Pressure Lubricant" is evolved. When sufficient local heat is developed by contact of the steel surfaces, the additive in the Extreme Pressure Lubricant decomposes. The active ingredient is liberated and immediately reacts with the steel surfaces at points of contact, forming a new and softer surface — viz., Iron Sulphide, Chloride or Phosphide as the case may be. These newly formed surfaces, being relatively soft act as excellent bearing surfaces in themselves and become self lubricating. They also act as an anti-flux and prevent any tendency towards incipient welding.

Provided the heat in these parts can be quickly removed so that the newly formed surfaces are not destroyed, and this is accomplished by the liquid lubricant surrounding them, excellent performance under Extreme Pressure operation is obtained.

NOTE: Extreme Pressure Lubricants do not perform as such between bearing surfaces other than steel on steel. For the lubrication of worm gear drives, where bronze on steel is utilized, the relatively soft and good bearing metal "bronze" operating against the harder "steel" provides an excellent condition of "solid lubrication". This only requires a lubricant that quickly removes heat and prevents softening of the bronze. A straight mineral oil or a mineral oil containing a small quantity of fatty oil is the lubricant most generally used in this type of mechanism.

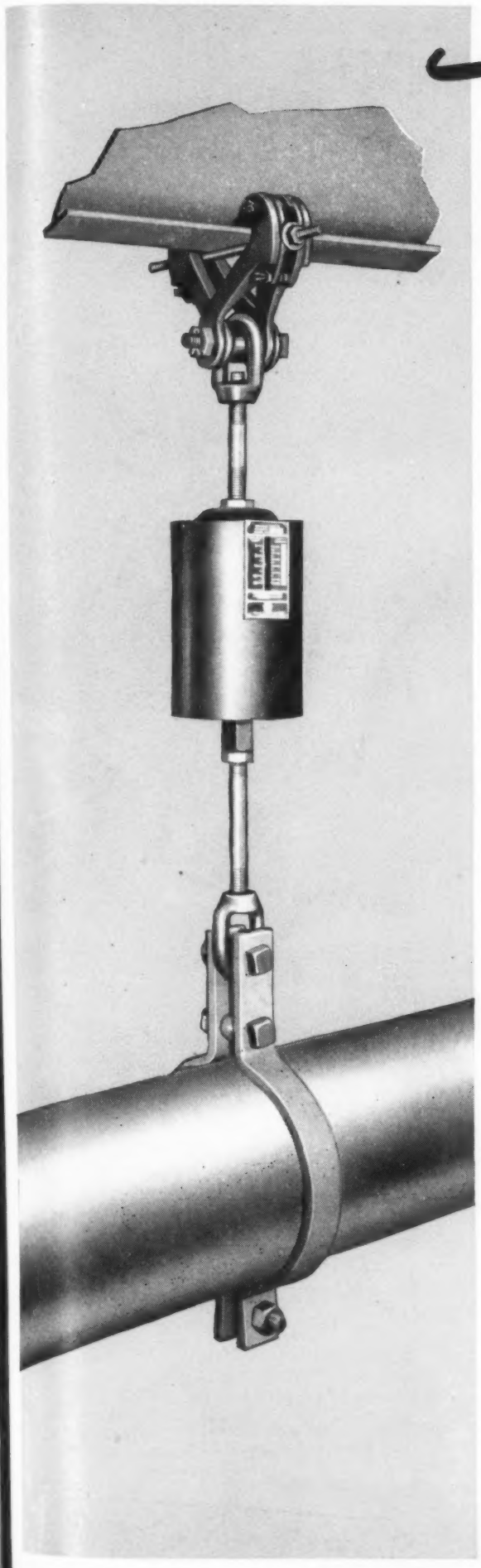


Extreme Pressure areas

INDUSTRIAL TYCOL OILS-GREASES

Gasoline Powers the Attack — Don't Waste A Drop

SCIENTIFICALLY ENGINEERED FOR EVERY INDUSTRIAL USE TYCOL



Minimum Variation

in Pipe Supporting Force

with

GRINNELL *Pre-Engineered* SPRING HANGERS

An inherent characteristic of a simple spring hanger is that the supporting force varies with the deflection of the spring. This change in supporting force often acts to set up undesirable stress in the piping.

The Grinnell Pre-Engineered Spring Hanger permits a uniform variation in supporting force of not more than 12½% in ½" deflection of the spring.

ALL-STEEL WELDED CONSTRUCTION MEETS PRESSURE PIPING CODE

UNIQUE SWIVEL COUPLING PROVIDES ADJUSTMENT AND ELIMINATES TURNBUCKLE

COMPACT—REQUIRES MINIMUM HEADROOM

INSTALLATION IS SIMPLIFIED BY INTEGRAL LOAD SCALE AND TRAVEL INDICATOR

EASY SELECTION OF PROPER SIZE FROM SIMPLE CAPACITY TABLE

14 Sizes with a Load Range from 84 lbs. to 4700 lbs.

Write for this folder on Fig. 268 Pre-Engineered Spring Hanger.
Grinnell Company, Inc.
Executive Offices, Providence 1, R. I.
Branch offices in principal cities.

GRINNELL

WHENEVER *Piping* IS INVOLVED

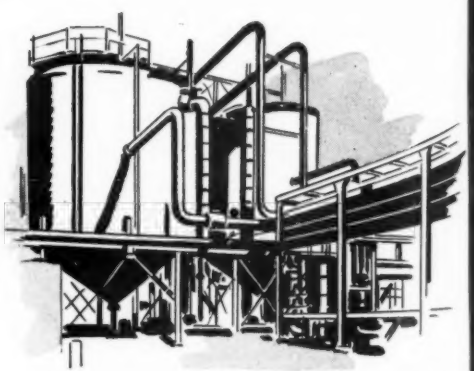
"No scale or corrosion," report Permutit-equipped plants . . .

War-working boilers can't take time off, while damages—caused by impurities in feedwater—are repaired. So at thousands of war plants Permutit* equipment *removes* these impurities before the water enters boilers.

Permutit is the world's largest manufacturer of water conditioning equipment. Permutit processes for control of water quality include Hot and Cold Lime Soda Softeners, Zeo-Karb* Water Conditioners, Spaulding Precipitators, Deaerating Heaters, Degasifiers, Silica Removal, Continuous Blowoff and Demineralizers that produce a low-cost substitute for evaporated water.

Write us about *your* water problem. Address The Permutit Company, Dept. A, 330 W. 42nd St., New York 18, N. Y. . . . or Permutit Co. of Canada, Ltd., Montreal.

*Trademarks Reg. U. S. Pat. Off.



PERMUTIT HOT LIME SODA WATER SOFTENER

Lime and soda ash precipitate bulk of water hardness as calcium carbonate and magnesium hydroxide. Sludge that forms is settled out and water is filtered. Integral heater simultaneously deaerates the water.

PERMUTIT

WATER CONDITIONING HEADQUARTERS

Serving industry and the armed forces...with GOOD WATER

PRESSURE

* This is the 11th of a series of informative messages concerning the meaning and significance of commonly used tests and terms employed to describe the characteristics of lubricating oils.

DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

Whatever your lubricating need – extreme pressure, high or low temperature, high speed, or any other service condition – there's a Tycol oil or grease exactly suited to your specific need.

Tide Water Engineers will recommend the Tycol lubricant that meets your particular requirements. Call or write your nearest Tide Water office.

TIDE WATER ASSOCIATED OIL COMPANY

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL • Eastern Division: 17 Battery Place, New York 4, N. Y.
Principal Branch Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N. C.

INDUSTRIAL LUBRICANTS

HOW'S YOUR VOLTAGE?

You can often iron out difficulties by regulating voltage--and SAVE

New England lab cuts testing time

This laboratory, testing electronic tubes and communications equipment, was getting uncertain test results because of a fluctuating incoming line voltage. It was necessary to repeat some tests over and over to assure accuracy. G-E engineers suggested installing three 3.6-kva, 120-volt automatic induction regulators. These regulators now furnish the exact voltage required for each test, and hold it constant throughout the test. Over-all testing time has been cut in two.

Aircraft plant saves—and speeds inspection

A midwestern manufacturer X-rays all propellors before releasing them for duty, to make sure that they are perfect. Considerable time was being lost because of fluctuations in the voltage applied to the X-ray machine. Underexposure or overexposure of X-ray film was the rule rather than the exception. Numerous "retakes" were necessary. This problem was ironed out with an automatic G-E 2.4-kva, 240-volt, induction regulator. Not only was time saved and production increased but the savings in X-ray film alone paid for the regulator in three months.

Western power company saves critical material

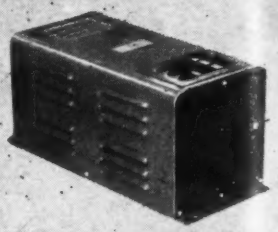
A western radio station experienced trouble because varying loads caused voltage fluctuations on the feeder supplying the station with 240-volt, three-wire, single-phase service. For the power company serving this area to install an *independent* feeder, would have required a large amount of critical material, and would have been difficult because of its effect on the station's elaborate antenna counterpoise. This problem was solved by installing a 2.4-kva G-E induction regulator on the *existing* feeder. Voltage regulation is now reported excellent.

What is your problem?

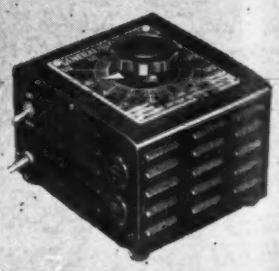
Pepless motors, poor lighting, uncertain test results, and production slumps are often the result of poor voltage. Whether you need voltage control for an electronic tube or a power shovel, there's a simple, economical G-E device for the job. Ask your G-E representative for further information. *General Electric Company, Schenectady 5, N. Y.*

Motor-operated regulator typical of sizes 3.6 kva and smaller. For automatic operation, control panel is furnished separately.

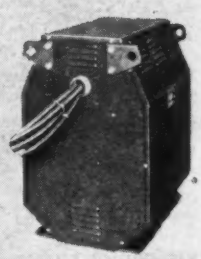
OTHER G-E AIDS TO BETTER VOLTAGE



VOLTAGE STABILIZER—Automatically provides a constant 115-volt supply to a given load, on circuits varying from 95 to 130 volts. Ratings from 50 to 5000 va. Ideal for precision laboratory or manufacturing processes, or built into such equipment as radio transmitters.



VARIABLE-VOLTAGE AUTO-TRANSFORMER—Provides smooth, adjustable control of voltage, current, light, temperature, power, and speed at a turn of the dial. Ratings from 243 to 810 va. Ideal for use in factories, laboratories, and assembled with other equipment.



TYPE D TRANSFORMER—For insulating lighting circuits, reducing light flicker, boosting or stepping down voltage for the most economical operation of motors, welding equipment, etc. Ratings up to 100 kva, 600 volts.

THE RIGHT VOLTAGE AT THE RIGHT PLACE DOES THE JOB BETTER

GENERAL ELECTRIC

HEAT TRANSFER

. . . and a few often-neglected factors that affect it

The *thermal conductivity* of a metal is one thing.

The actual *heat transfer* from one fluid to another through the metal may be a different story altogether.

For thermal conductivity is listed on an *ideal* working basis. It does not take into account the practical factors that may slow down heat transfer under working conditions.

It does not allow, for instance, for corrosion deposits and films that form on metallic walls or for heating or cooling gases that cling to the metallic walls. These films have such low conductivity that they often make relatively unimportant the conductivity of the metal itself.

The diagram (below) illustrates the slow-up in heat transfer from corrosion products and film. The table lists the conductance ranges for metal walls, and for films that may form upon them.

These comparative figures show why other factors than rated thermal conductivity are of greater importance in heat transfer equipment.

All the INCO Nickel Alloys are highly resistant to corrosion, even at high temperatures. They develop very thin and tenacious oxides within their limiting temperature range. They do not scale or build up heavy insulating jackets of corrosion deposits. Their clean smooth surfaces keep down accumulations of sludge and deposits which might retard heat transfer.

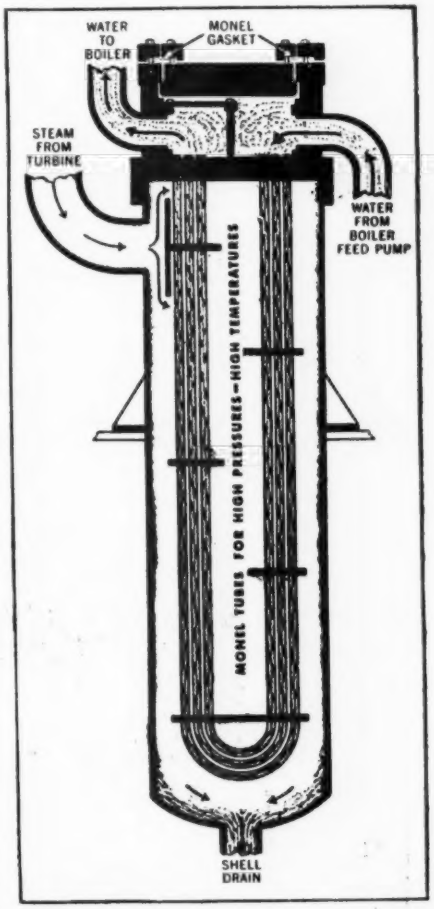
These are the reasons for the remarkably rapid heat transfer rates which nickel and the INCO Nickel Alloys provide under actual service, especially where corrosive conditions and high temperatures are encountered.

* * *

A practical example which illustrates the usefulness of INCO Nickel Alloys for heat transfer work is the performance of Monel tubing used in three of the latest high-pressure power stations:

TWIN BRANCH PLANT, of the Indiana and Michigan Electric Company, a subsidiary of the American Gas and Electric Service Corporation. The plant was designed to generate steam at a new high pressure for commercial units . . . 2500 lbs. Steam bled from the turbines at temperatures as high as 637° F., and pressures as high as 700 psi, surrounds the Monel tubing through which 550,000 pounds of water an hour rush under pressure of 3200 psi. Despite the speed at which it moves, the water is boosted from 353° F., to 490° F., due to the excellent heat transfer properties of the Monel tubing.

NARRAGANSETT ELECTRIC CO., Providence, R.I. Steam is bled from the turbine at 700° F. 430,000 pounds of water, under pressure of 1300 psi, pass through the Monel tubing every hour. The water is pre-heated to 400° F., before entering the high-pressure boiler.



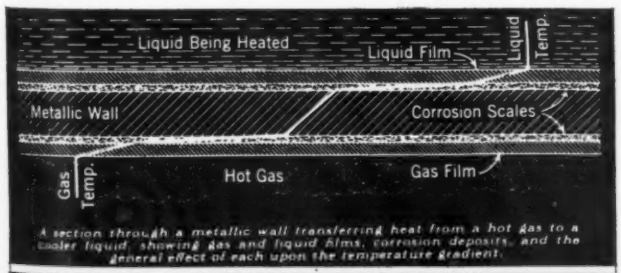
Cross-section of typical heat exchanger of the type used in Narragansett Electric Co. Plant. Note use of Monel Tubing.

OSWEGO PLANT of the Central New York Power Corp. Steam is bled from the turbine at 770° F., at a pressure of 600 psi. Internal water pressure in the Monel tubing is 2000 psi. The swiftly rushing water is pre-heated to 450° to 485° F.

Recently, all three installations were inspected. In addition to performing their heat transfer job, the Monel tubes in these heaters have stood up perfectly under the high pressures, high temperatures, and corrosive, erosive attack to which they have been subjected.

For further information about heat transfer, write for the INCO Technical Bulletin: "Heat Transfer through Metallic Walls." Address:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 WALL STREET NEW YORK 5, N. Y.



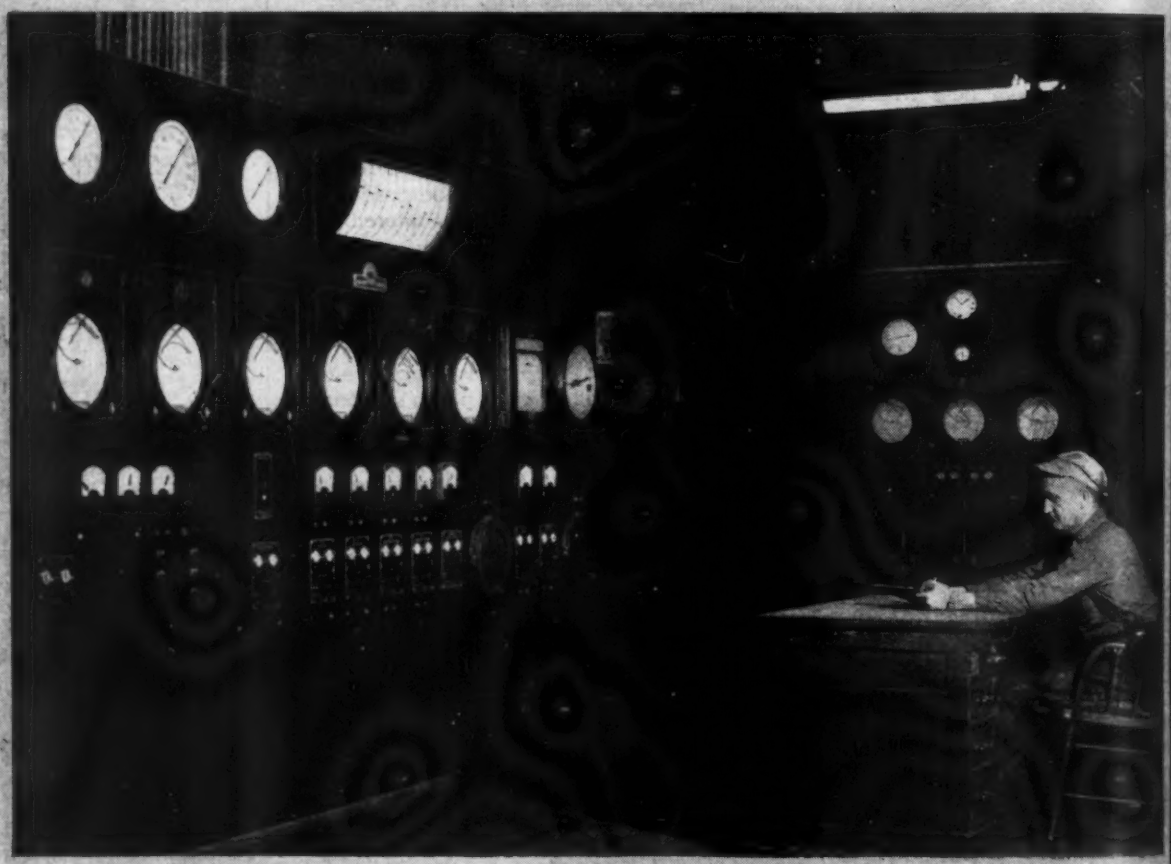
A section through a metallic wall transferring heat from a hot gas to a cooler liquid, showing gas and liquid films, corrosion deposits, and the general effect of each upon the temperature gradient.

Comparison of the Conductance Ranges for Metallic Walls and Films

Nature of Obstruction	Conductance Range Btu./hr. sq. ft./°F.
Metal wall	
1 in. thick	75 to 3,000
0.025 in. thick	3,000 to 120,000
Condensing vapor	1,000 to 4,000
Evaporating liquid	500 to 2,000
Liquid being heated	50 to 500
Liquid being cooled	40 to 400
Gas being heated	5 to 50
Gas being cooled	5 to 40
Corrosion scale	5 to 20

ENGINEERED

Conserves — FUEL



Bailey Boiler Control at the Wyandotte, Michigan Plant of Wyandotte Chemicals Corporation

BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERH

INSTRUMENTATION

★ To be truly effective in the conservation of fuel, manpower, transportation, and major equipment, boiler room meters and control systems must be carefully engineered to the particular requirements of the plants which they serve.

Thorough instrumentation engineering starts with a careful consideration of improvements which may be effected; and continues through with the application, design, construction, calibration, installation and adjustment of the meters and controls necessary to secure these desired improvements.

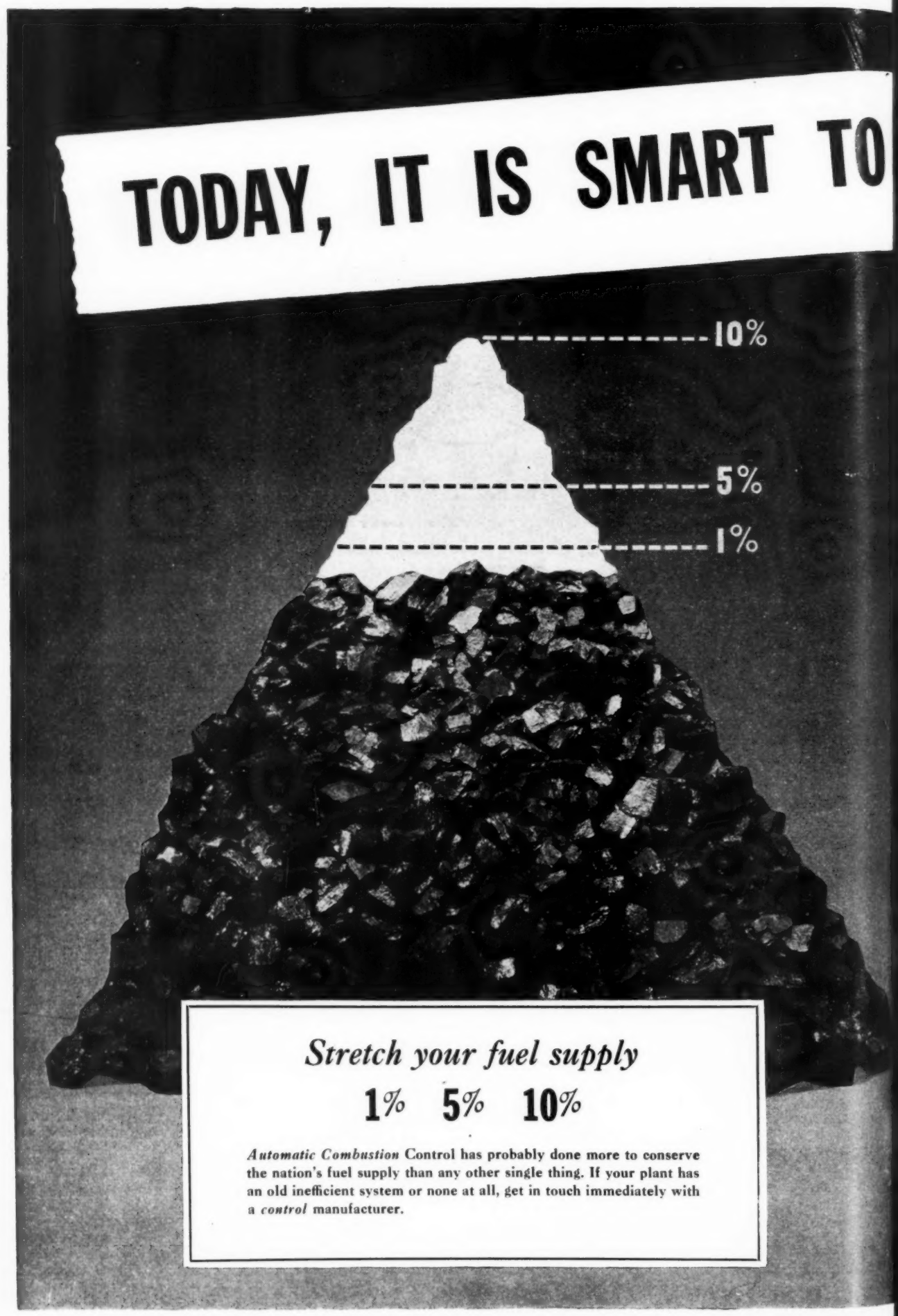
Bailey Meter Company, through its staff of thoroughly trained and experienced combustion engineers is helping power plant engineers to achieve their wartime conservation objectives.

Bailey Engineers are stationed in over 30 industrial areas throughout the United States and Canada for the purpose of rendering prompt "on the spot" engineering service without undue traveling expense. The Bailey Engineer in your community has a vast store of data at his command which includes results from tests on thousands of boiler installations covering a wide range of fuels, furnaces and fuel burning equipment. You will find that he has more to offer than meters and controllers. He is primarily interested in helping you to secure maximum fuel conservation together with the other benefits which result from intelligent use of correctly selected and properly applied instrumentation. G-22

BAILEY METER COMPANY
1036 IVANHOE ROAD • CLEVELAND 10, OHIO
Bailey Meter Company Limited, Montreal, Canada

. . . The Complete Boiler Control System

ROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL


TODAY, IT IS SMART TO
10%
5%
1%
Stretch your fuel supply
1% 5% 10%
Automatic Combustion Control has probably done more to conserve the nation's fuel supply than any other single thing. If your plant has an old inefficient system or none at all, get in touch immediately with a control manufacturer.

BE A "COAL-MISER"

— especially when you can improve overall operating efficiency at the same time!

ENGINEERS in hundreds of America's leading power plants are thankful that they had the foresight to equip their boilers with Hagan Automatic Combustion Control.

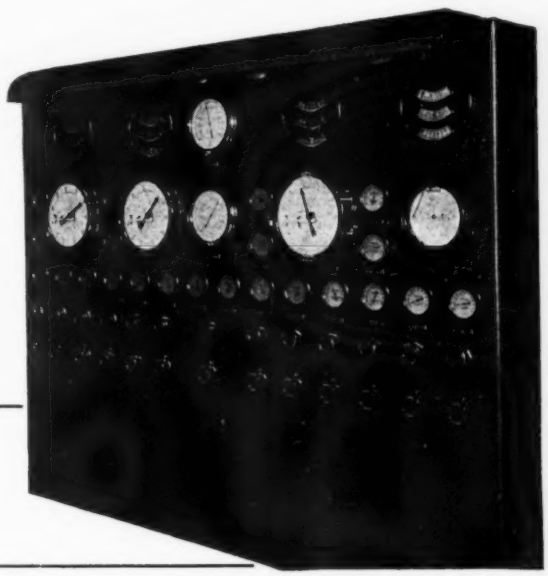
Today, coal has suddenly become a scarce commodity. Stretching what you have from 1 to 10 per cent through better combustion efficiency takes on special importance.

You *can* get such results, even though your firing equipment is *good*. Under less favorable conditions, a greater saving is not uncommon.

Reduced fuel consumption is just *one* of the many advantages offered by Hagan Control. Sound engineering and rugged construction make Hagan Control fast, accurate and dependable. How dependable is strikingly illustrated in a story just released by the War Shipping Administration.

An Africa-bound freighter had a 20 by 30-foot hole torn in her side by a torpedo. She was making tons of water, heeling over and settling down 12 feet by the head when the captain gave the "abandon ship" order . . . but that ship didn't sink! When engine department volunteers returned aboard they found that the plant was still seaworthy. The Hagan Automatic Combustion Control was still on and maintaining steam at the same pressure as before the "abandon ship" order was given. The freighter zigzagged to safety and continued on to port, 850 miles away!

Just those two factors — reduced fuel consumption—absolute dependability—are in themselves enough to warrant full inquiry. Shall we give you further information?



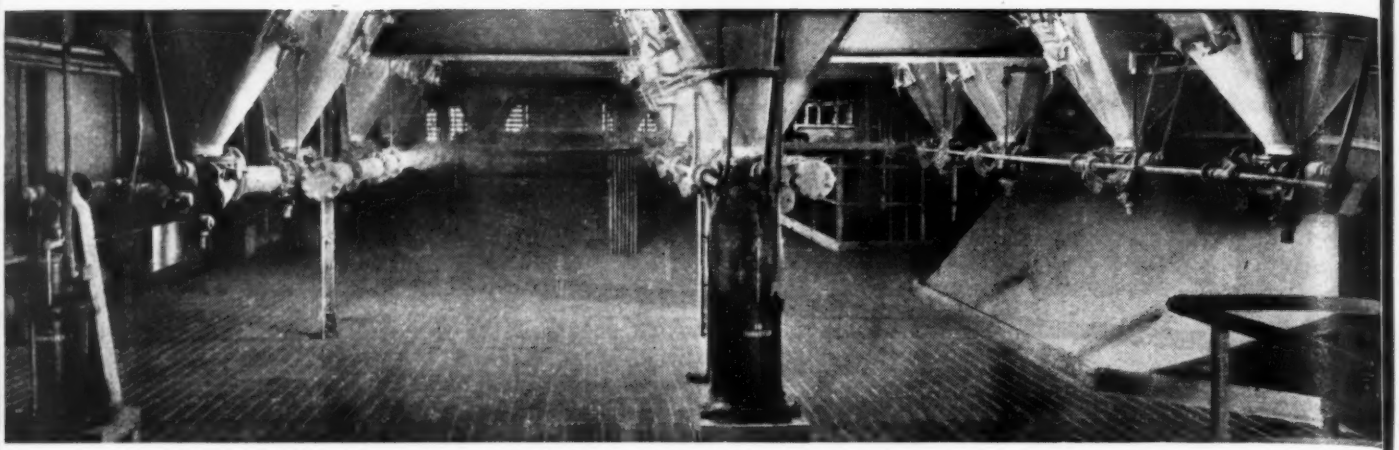
HAGAN
HALL
BUROMIN
CALGON

6.7% Coal Reduction per K.w.h. by this installation of Hagan Automatic Combustion Control in a medium-sized power plant.

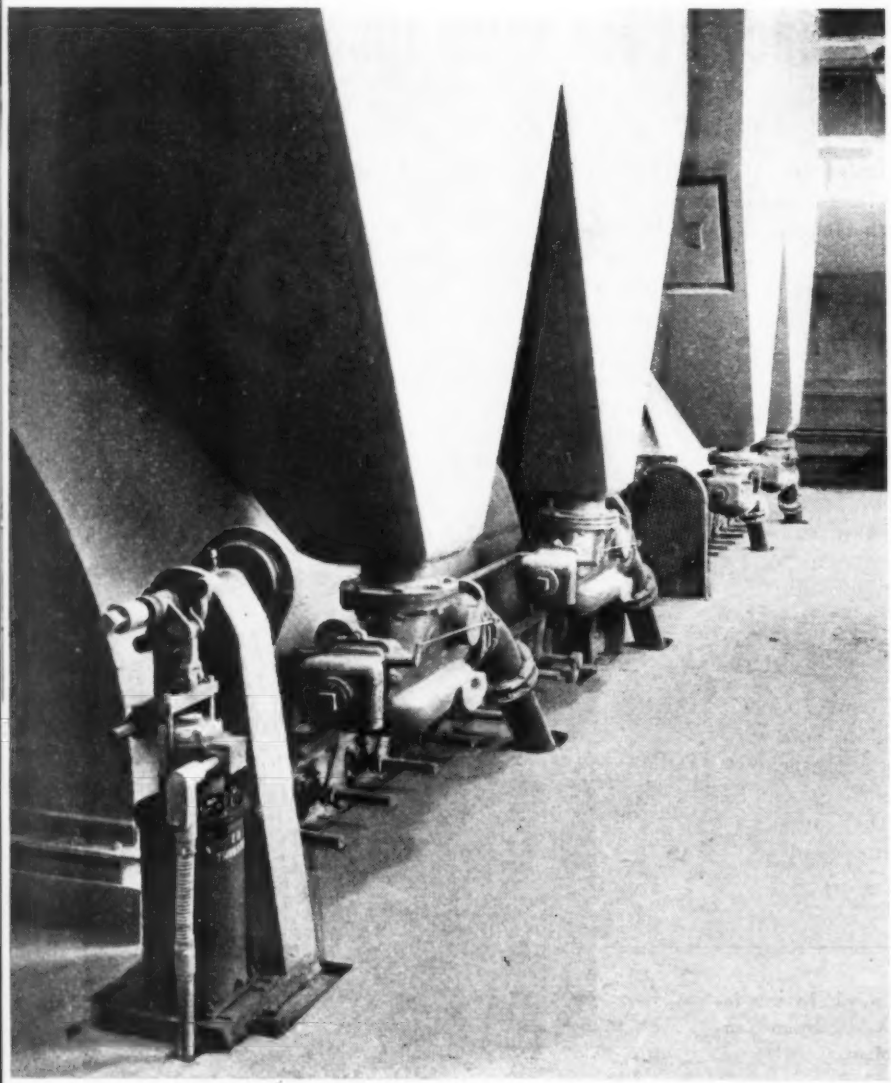
HAGAN CORPORATION · HAGAN BUILDING · PITTSBURGH 30, PA.

HAGAN *Automatic* COMBUSTION CONTROL

The pioneer . . . and still the leader



Battery of Windswept Dust Valves beneath Precipitator Hoppers, automatically operated by control panel in basement.



Windswept Dust Valves beneath Air Preheater, which operate after Precipitator Hoppers are empty.

AUTOMATIC HYDROVAC Dust Removal SYSTEM

Dust removal with the Automatic Hydrovac System is as easy and simple as the turning-on of an electric light. The operator merely pushes a button on the control panel and then goes about his other jobs. No attendance is necessary. No scurrying around the plant to various dust hoppers. No waiting around while dust is being removed. In fact, no work at all, and since no dust can escape from the system, there's no cleaning up afterward. Final dust disposal may be to sump, bin, or fill. . . . You won't be satisfied with anything else, once you get the full story of Automatic Hydrovac, from us and from users.

HYDROJET HYDROVAC

ALLEN-SHERMAN-HOFF CO. 227 S. 15th Street Philadelphia 2, Pa.

UNSUNG HEROES OF THE AIR

Written Specially for the Allen-Sherman-Hoff Co.

BY *Lowell Thomas*

Famous Radio News Commentator and Author

There are more unsung heroes fighting in this war, I suppose, than in all the other wars of history rolled together. Explorers who have gone into remote regions in search of rare minerals, and products of the jungle; men in the intelligence services who in this war have an infinitely more difficult job than ever before; paratroopers dropped behind the lines whom we never hear about; war correspondents who have suffered more casualties in proportion to their numbers than any other single group taking an active part at the various fronts; doctors, nurses, stretcher bearers and ambulance drivers, for whom the hazards are now far greater than ever; ground crews at advance air bases, and so on. The list is endless. But right at the head of it should go the flyers whose job it is to ferry planes across the oceans, and fly the endless stream of munitions that go by the sky route.

From my observer's seat it seems that they have had far less recognition than they deserve. For years I have been either directly or indirectly associated with the world of aviation, and scores of my friends are among the old-time flyers who were the first to join the Ferry Command. For example, one of the top flyers of our time is a young-old man named Clyde Pangborn. There are some who rank him Number One. His round-the-world flight long years ago was just one of his endless string of achievements. And in this was included a record that still stands, when he made man's first non-stop flight right across the vast Pacific Ocean. And, the amazing thing is that it has never been flown non-stop since. Where is Pang now? Why, he's a Captain in the R.A.F. Ferry Command.

Some of the most interesting flights that I have ever made have been with the pilots who are now spanning the hemispheres. And never will I forget that night, not long ago, at Natal, Brazil, the Number One jumping-off place for the men who fly the South Atlantic. Air Force General Bob Walsh, in command there, suggested that we stay up all night, sit-in with the veteran pilots—and the youngsters, too—at their "briefing;" then see them into their planes, and watch them vanish over the South Atlantic.

Occasionally the flyers and ground crews needed a little extra manpower to clear a path through the rows and rows of four-engined and twin-engined bombers lined up there and waiting to make the long jump to Africa—some to take it straight, others to make it by way of lonely Ascension Island. Sometimes the General and I supplied that extra manpower.

All through the night a steady stream of planes, with blue flames shooting from their exhausts, went roaring down the more-than-a-mile-long runway, up into the darkness, and out over the Atlantic, bound for Africa, Asia and Far Countries.

One of the Air Transport pilots, a young Frenchman who now has rolled up several thousand hours in over-ocean flying, told me a story of one of his Pacific experiences. Some years ago when the Chilean government decided to create a ski corps for patrol work in the high Andes, Blue Devil Jacques Charmoz and a fellow French Olympic skier were loaned by the government of France to Chile, to train the Chilean Army. When this war broke out, Charmoz decided to return home as a flier, rather than as a Chausseur Alpin. But his country was overrun before he could get home. So he came north from Chile, bought his own plane, and at his own expense and with indefatigable labor, piled up hours at night flying, studied all types of navigation, and finally talked the R.A.F. into taking him. In fact, today, he and five others are the only French airmen in the trans-oceanic flying game.

Later, when Uncle Sam was desperately in need of experienced airmen to fly bombers across the Pacific, Captain Jacques Charmoz of the R.A.F., for a time was loaned to the American Army Air Forces. In addition to flights back and forth across the Pacific, he made some eighteen trips rushing Commandos from Australia to New Guinea. That was when the Japs had crossed the Owen-Stanley Mountains, and were threatening to take Port Moresby.

On his way back from one trip to the Antipodes he and another R.A.F. Captain were invited to return as passengers in a twin-engined cargo ship. They didn't relish the idea, because they knew the plane had a fuel capacity that would allow only for an extremely narrow margin of safety on some of those big Pacific jumps. But, it was hot as blazes in New Caledonia, and there was no telling when another plane would be heading toward America. So, they decided to go along.

All went well until they were on the lap between Canton Island and Hawaii. This, by the way, was right at the time when Captain Eddie Rickenbacker and his companions were down somewhere on the Pacific, and every surface ship and plane that could be spared was taking part in the search.

In that cargo plane with Jacques Charmoz and his pal there was a third passenger, a distinguished officer, making the trip in a long wooden box. That coffin occupied so much of the space that the two French officers had to use it as the table when they dined. Also, they played gin rummy across it.

After flying for some hours on that Canton-Hawaii lap, Jacques figured that the plane must be nearly out of fuel, and seeing no sign of any islands he went up to the cockpit and asked the Captain how they were getting on. The young American pilot shook his head, said he didn't know, in fact, wasn't sure when they would make a land-fall, but that undoubtedly the navigator had them on the beam.

Next Captain Charmoz asked the navigator if he knew where they were, and the latter replied that he was working on it, but was uncertain. However, he said he was sure the radio operator, who seemed awfully busy, must be in touch with Hawaii. When Charmoz tried to question the radio man, the latter waved him aside. So, he went back and continued the game of cards across the coffin. More time passed, and by now he was dead certain the fuel tanks must be almost empty. So, he went over to the radio man who was still busy, determined to wait this time until he found out. After a few minutes the wireless operator threw up his hands and shouted joyfully: "They've found him! They've found him!"

All the time he had been listening to the radio conversations that just about blanketed the Central Pacific, wireless messages in connection with the search for Rickenbacker—who at that moment had been found.

But, the rejoicing radio operator didn't know the position of his own plane! While he was cheering the rescue of Captain Rickenbacker and his companions, he, himself, and those with him were lost!

The story, of course, had a happy ending. They made it by an eyelash. A few minutes later, just as they ran out of gas, they sighted one of the islands of the Hawaiian group.

There are endless untold tales of high adventure to be related by the young airmen who have been ferrying bombers to all parts of the planet. Surely no greater saga could be written than the story of their flights.

WRITE FOR LOWELL THOMAS BOOKLET

Following the publication of a few of these Lowell Thomas stories, we plan to publish the entire group in booklet form. In order to help us decide on how many to print, we'd appreciate your writing us now, so that we can reserve a copy for you. No obligation, of course.

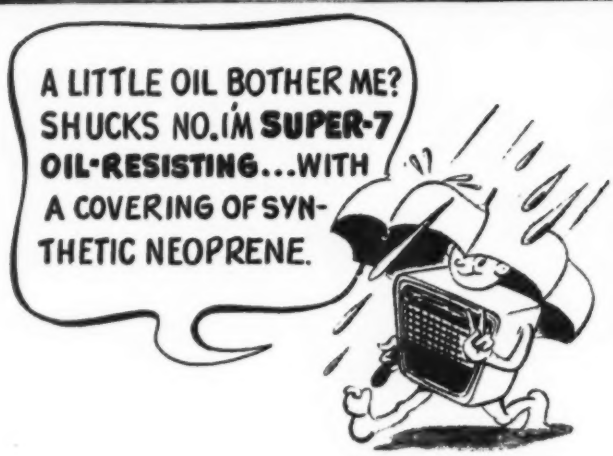
HYDROSEAL HYDRO BIN

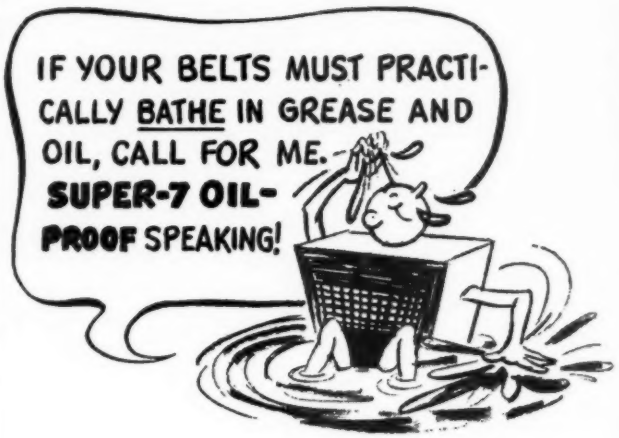
OFFICES AND REPRESENTATIVES IN MOST PRINCIPAL CITIES

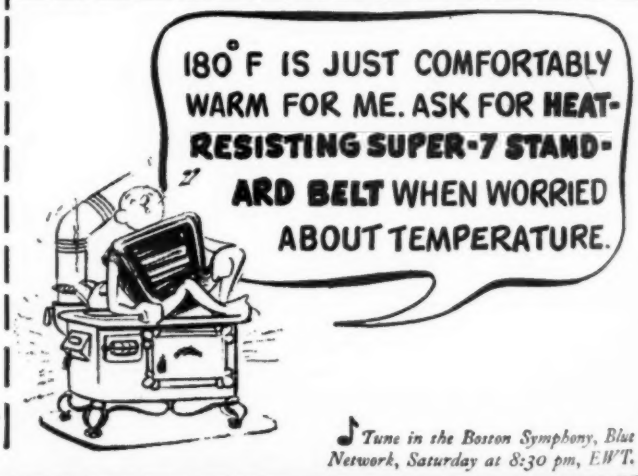
INTRODUCING ALLIS-CHALMERS' New V-Belt Family!

To lick every one of your different belt problems, you can be sure of finding the right belt in America's newest and widest V-belt line . . . Allis-Chalmers' Texrope!

I'M SUPER-7-STEEL--NEWEST AND STRONGEST MEMBER OF TEXROPE'S V-BELT FAMILY. EXTRA-HEAVY LOADS, FIXED CENTER DISTANCES ARE WHERE I SHINE.







A 1733

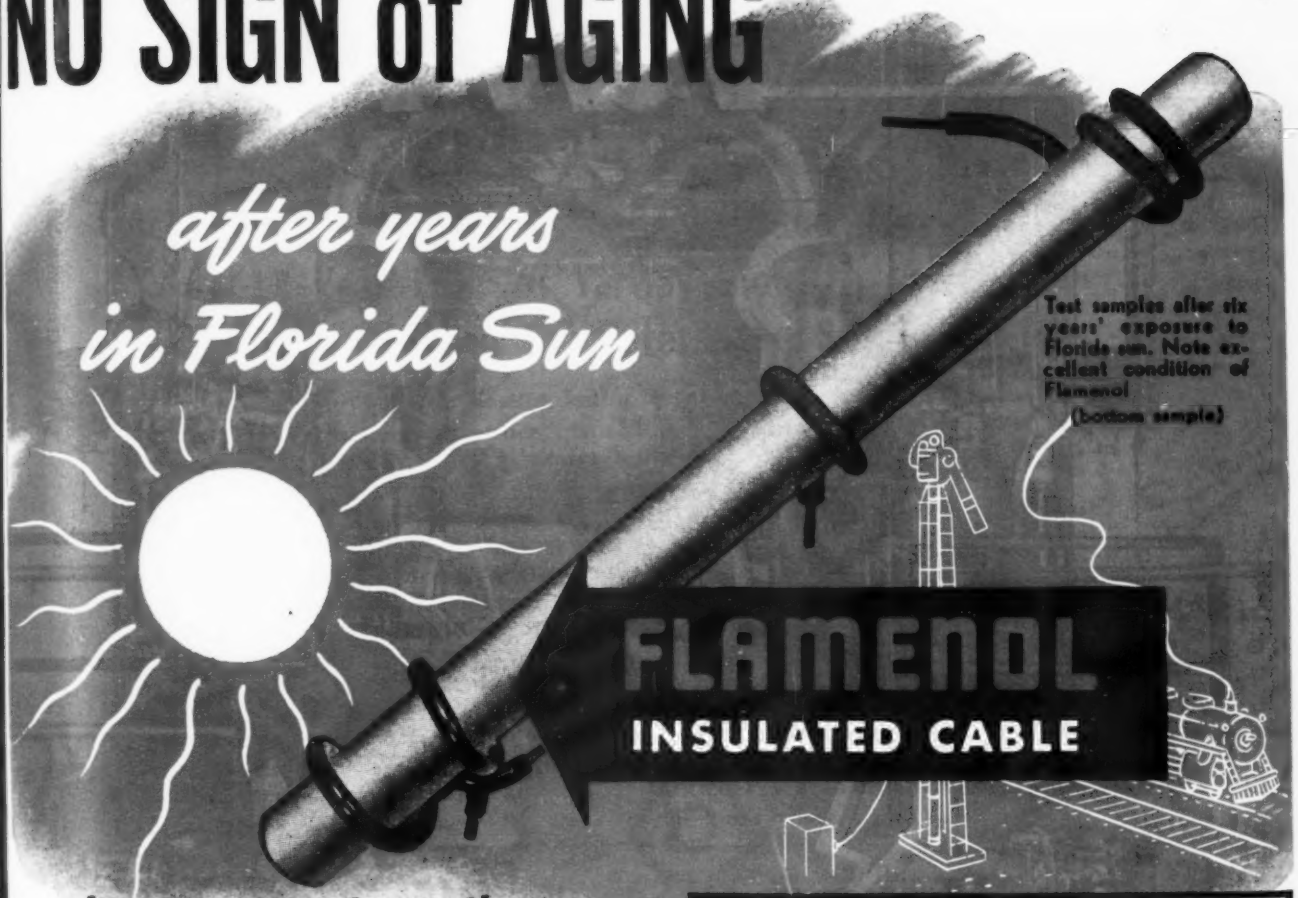
Tune in the Boston Symphony, Blue Network, Saturday at 8:30 pm, E.W.T.

IT PAYS TO MAKE ALLIS-CHALMERS YOUR V-BELT DRIVE HEADQUARTERS

Texrope Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

NO SIGN of AGING

after years in Florida Sun



Test samples after six years' exposure to Florida sun. Note excellent condition of Flamenol (bottom sample)

Long exposure to weather proves value of G-E synthetic cable for outdoor applications

In 1937, a large railroad operating in the South decided to compare the aging qualities of various cable insulations. Line drops of three types of cable—one had an oil-base rubber insulation, one had a mineral-base rubber, and one was Flamenol*—were installed. None of the cables was braid covered—in each case the insulation was exposed to sun and weather.

After six years' operation, the samples were removed for inspection. As shown in the photograph above, the insulation on two of the samples had aged considerably, but the Flamenol was still in excellent condition.

Flamenol—the pre-Pearl Harbor synthetic-insulated cable

When war broke out in Europe, millions of feet of Flamenol cable already had been installed in automotive, chemical, food, textile, and other plants, as well as in mines and oil refineries, and on railroads.

For wiring installations subjected to acid, alkaline, oily or moist conditions, fire hazard, or weather, Flamenol is the *proved-performance* cable. Note, at right, its operating, installation, and maintenance advantages. For complete information, ask our local office, or write to *General Electric Co., Schenectady 5, N. Y.*

11 BIG ADVANTAGES offered by FLAMENOL

1. **FLAME RESISTANCE**—does not support combustion.
2. **CORROSION RESISTANCE**—immune to action of oils, acids, alkalies.
3. **SUPER-AGING**—does not oxidize. Highly resistant to sunlight and weathering.
4. **EXCELLENT PHYSICAL PROPERTIES**—has minimum tensile strength of 1500 lb per sq in., minimum elongation of 100 per cent.
5. **DIELECTRIC STRENGTH**—retained at about 720 volts per mil through severe operating conditions.
6. **SMALL DIAMETER**—saves space, facilitates wiring.
7. **SMOOTH SURFACE**—facilitates pulling through conduit.
8. **FREE STRIPPING**—speeds splicing, avoids nicking conductors.
9. **DIFFERENT COLORS**—simplify circuit tracing.
10. **VARIOUS CONSTRUCTIONS**—aid selection for special applications.
11. **SELF-PROTECTING FINISH**—eliminates need for braid, less space required.

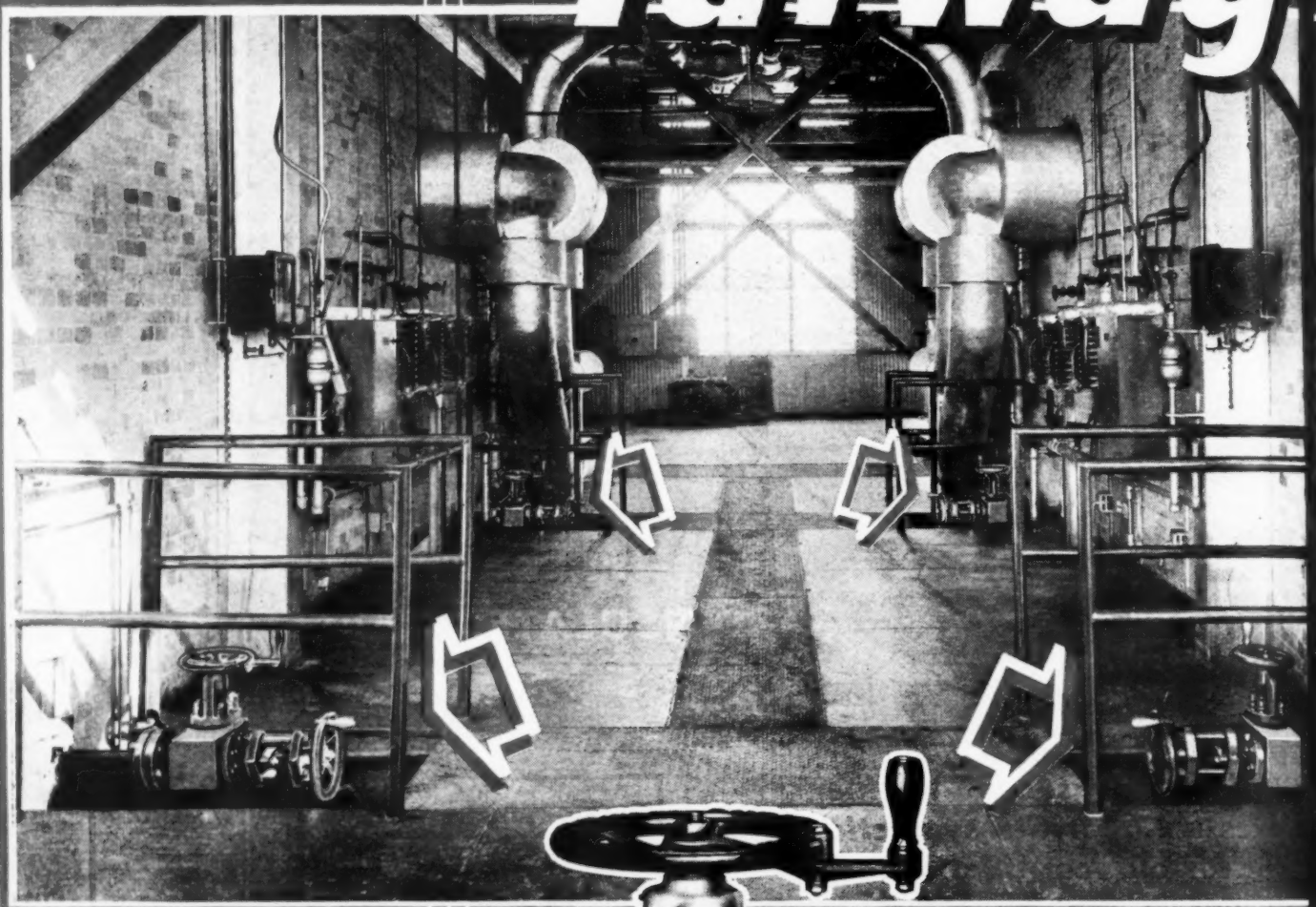
*Reg. U.S. Pat. Off.

BUY WAR BONDS

GENERAL ELECTRIC

660-14-1200

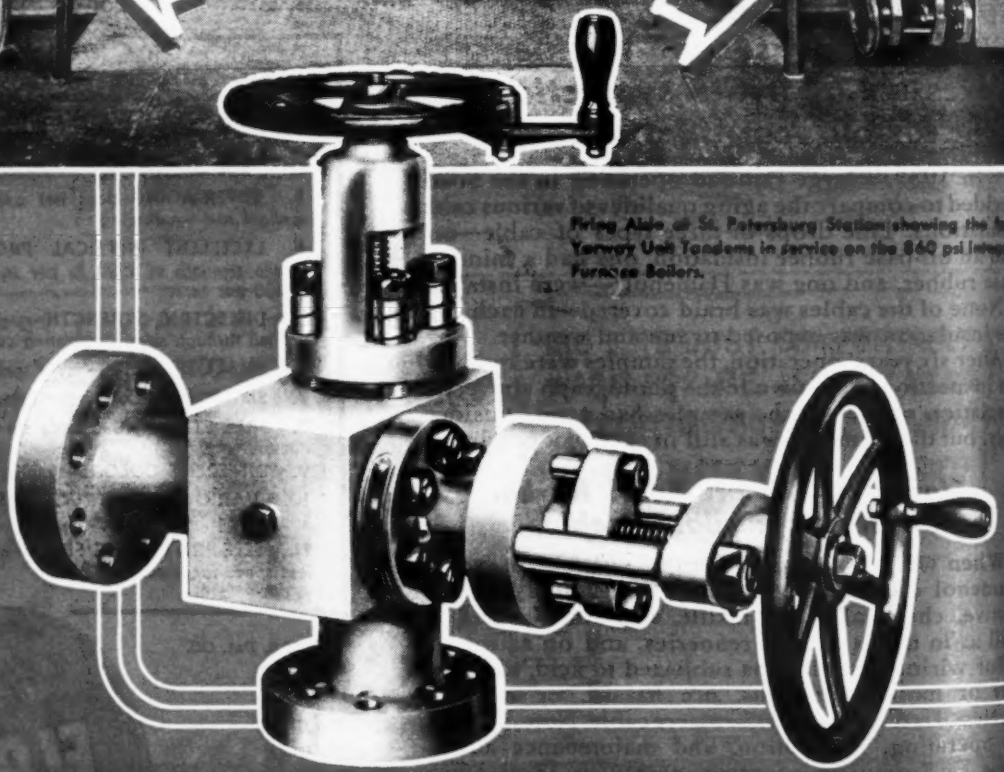
Yarway



Firing Aisle at St. Petersburg Station showing the four Yarway Unit Tandems in service on the 860 psi Integral Furnace Boilers.

Yarway Unit Tandems are built for pressures up to 2500 lb. Combining a Hard-Seat and a Seatless valve in a single one-piece forged steel body, this Tandem provides the advantages of both designs—for blowing or draining and sealing—in a compact, rugged unit.

Inside (next to boiler) blowing valve is the Yarway Hard-Seat Valve with special Stellited seat and disc and other features which greatly reduce wear in this type of valve. Outside sealing valve is the famous Yarway Seatless design. This valve is always opened first and closed last, maintaining a tight seal.



YARWAY

at "St. Pete"

Florida Power Corporation is 18 Year User of Yarway Blow-Off Valves at Both Inglis and St. Petersburg Steam Stations

The proof of any product can be found in the long experience of its users.

Way back in the early "twenties", the Florida Power Corporation started purchasing Yarway Blow-Off Valves for both the Inglis and St. Petersburg Stations—built to operate at approximately 350 lb pressure.

Years of satisfaction with these valves prompted the selection of the four Unit Tandems, illustrated, for the two recently installed 860 lb, 910° F. Integral Furnace Boilers at St. Petersburg Station.

Another in the long list of modern, high pressure generating stations to select Yarway Unit Tandems for both water-wall drains and main boiler blow-down lines.

Yarway Unit Tandems, built for pressures up to 2500 lb, combine a Hard-Seat and a Seatless Valve in a single, one piece forged-steel body. This Tandem provides the advantages of both valve designs—for blowing or draining and sealing—in a single, compact, rugged unit, the result of more than a quarter century of mechanical and metallurgical research and field experience.

For high or low pressure blow-down service, users say, "You can't do better than buy Yarways."

Write for Catalog, Section B-431 for pressures from 400 lb to 2500 lb. Section B-424 for lower pressures.

YARNALL-WARING COMPANY, 100 Mermaid Avenue, Philadelphia 18 Pa.

Close-up of one of the four Yarway Unit Tandem Blow-Off Valves, Fig. No. 3982-3938, at St. Petersburg Station.

BLOW-OFF VALVES

Progress and Power in TUNNELS AND SUBWAYS

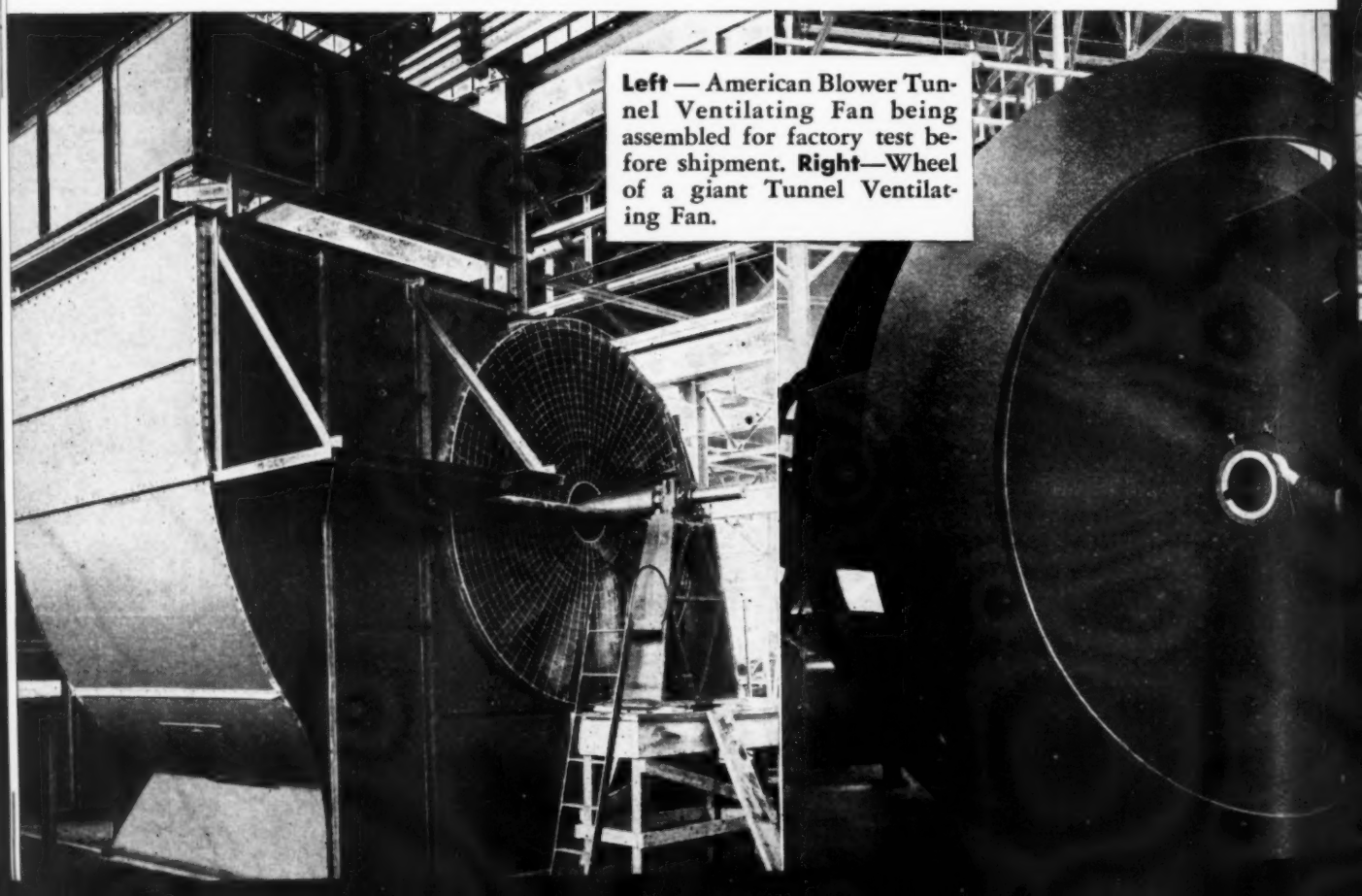
The progress made by America's great Public Utilities in furnishing low cost power for any and all needs, plus man's ability to conquer distance and time by means of tunnels and subways, marked a new era in the world . . . American Blower engineers contributed to this new age with equipment to handle air . . . In the early days of the New York subways, in the great Moffatt (R.R.) Tunnel near Denver, Colorado, down to the present day portals for the George Washington Bridge (N. Y.), American Blower Tunnel Ventilating Fans have played a vital role. In every job or industry where ventilation is vital to health, comfort and efficiency of people or workers, you'll find American Blower Equipment on the job.

ARMY E NAVY
For Production "Well Done"

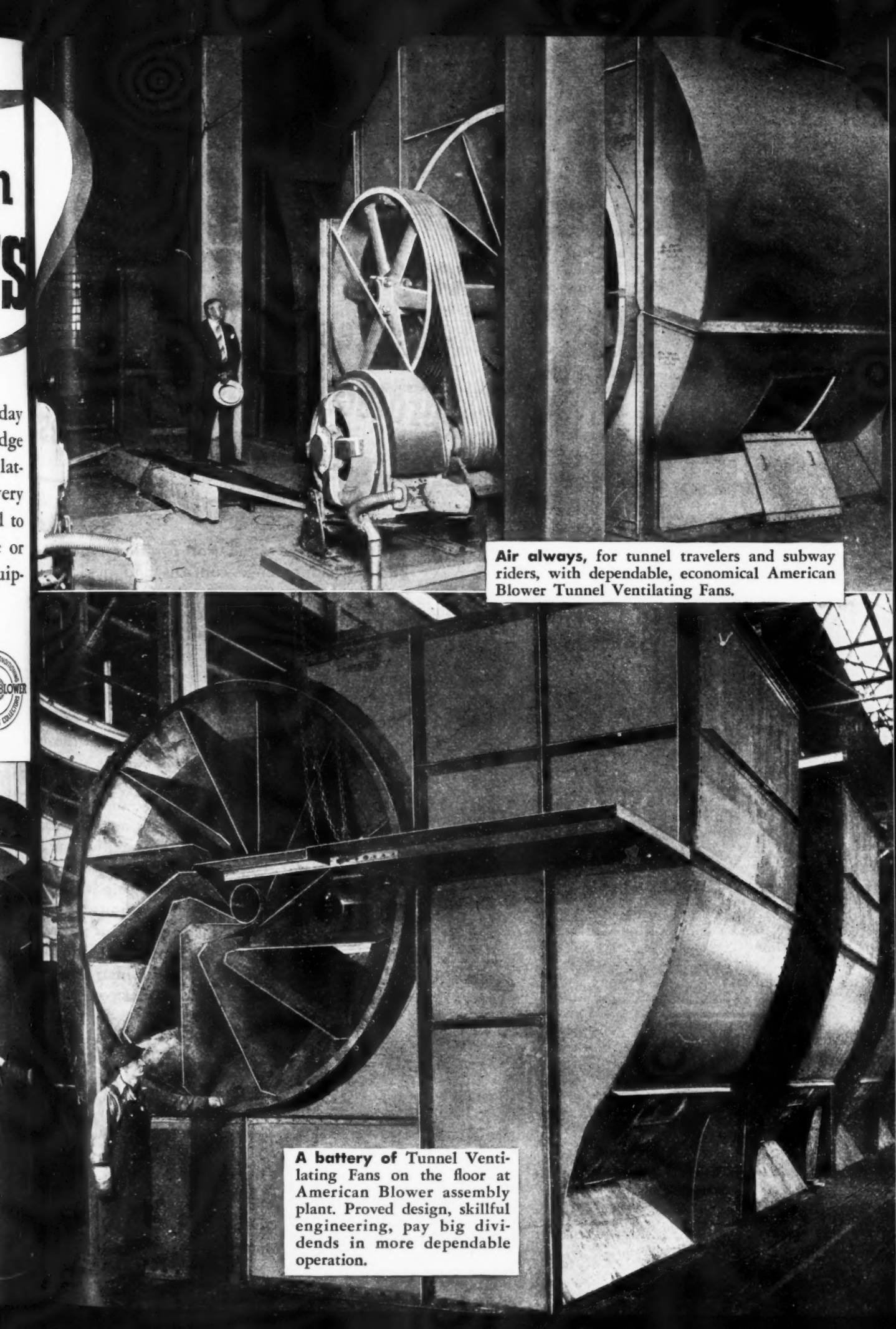
AMERICAN BLOWER

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary corporation

MECH DRAFT · AIR CONDITIONING · FLUID DRIVES · DUST COLLECTORS
AMERICAN BLOWER



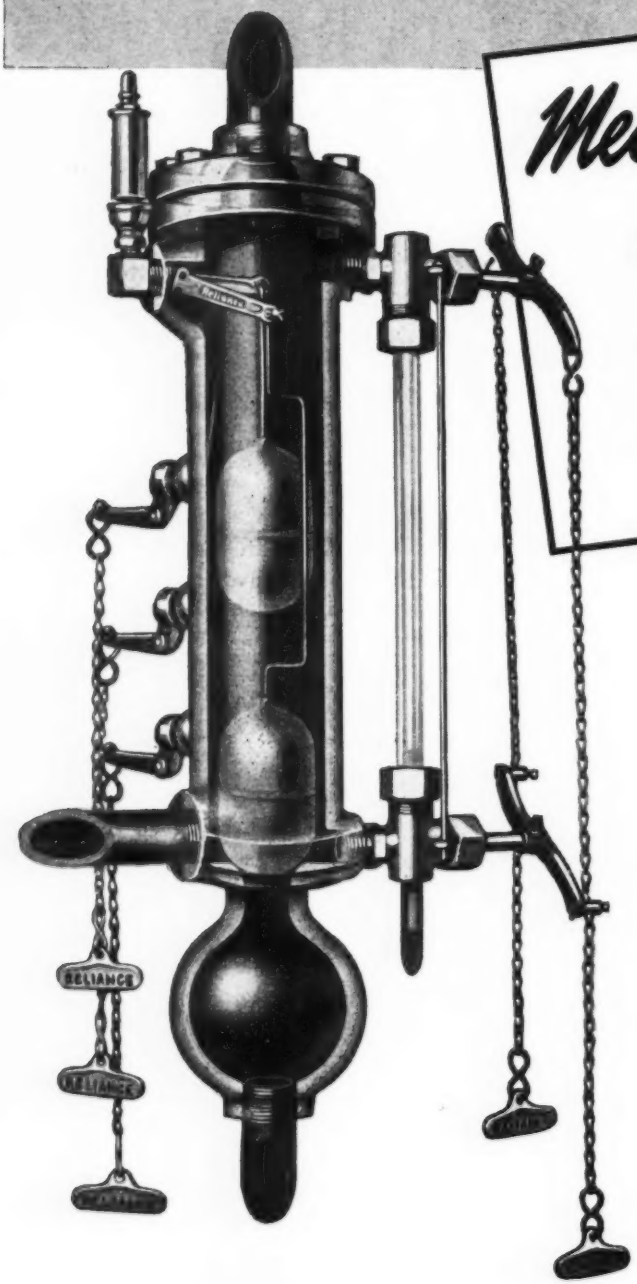
Left — American Blower Tunnel Ventilating Fan being assembled for factory test before shipment. **Right**—Wheel of a giant Tunnel Ventilating Fan.



Air always, for tunnel travelers and subway riders, with dependable, economical American Blower Tunnel Ventilating Fans.

A battery of Tunnel Ventilating Fans on the floor at American Blower assembly plant. Proved design, skillful engineering, pay big dividends in more dependable operation.

Why the Reliance Safety Water Colum



Mechanical Simplicity

assures positive boiler protection under today's "Win-the-War" stresses

Nowadays you're thankful for all the depend low maintenance controls and devices yo had the foresight to install. Owners of Reli Safety Water Columns know that their simplici their strength—their sensitive trouble-free me nism a known factor that guards boiler water le as faithfully as a military sentinel.

Action of the ALARM is direct and foolpr There's nothing to adjust or get out of order in operating mechanism, which is high in the colu safe from scale, sediment and corrosion. When w level falls below a safe normal, weight of the al float pulls open the whistle valve—the warning operators, helps prevent burned out tubes, cra headers, bulged sheets and serious explosions.

When water rises above a predetermined p high alarm float is buoyed up, opening whistle v to warn against the chance of priming or slug water carried over to damage engine or turbine.

You can be sure of maximum service from liance Alarms if simple installation instructions h been followed. We recommend that you check

Since 1884

Reliance

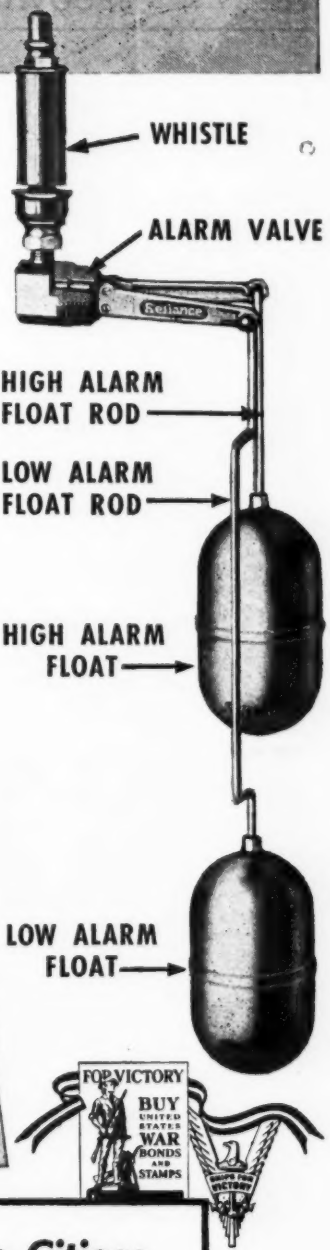
BOILER SAFETY DEVICES

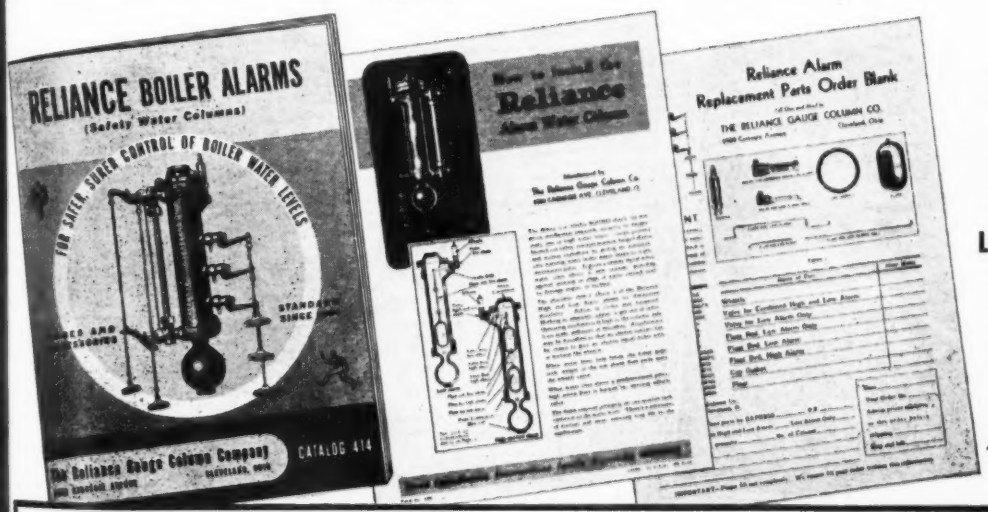
Vital to your busy War Production

fully the A.S.M.E. and local Code requirements and compare your hook-up with their rules. Be sure all connections run straight. Provide for cleaning by installing crosses with plugs at all right-angle turns as pipe and fittings often stop up with scale and sediment. Complete instructions for installing the column and replacing its parts are covered in Reliance Form Number 429.

Long wear, or unusual accidents while cleaning column and piping may necessitate some replacement of parts. As you probably know, you can order maintenance parts on an MRO priority. It will be helpful if you refer to *Reliance Replacement Parts Order Blank, Form 392-A*—or write for a copy—to give you the correct parts names. Always state the catalog number of your Reliance Column, which you find on the sediment chamber or on number plate.

The importance of insuring positive water level supervision through the Safety Water Column and adequate Gage Equipment is recognized by all competent engineers. . . . To keep up-to-date on construction facts write for latest Reliance Alarm Catalog 414.




RELIANCE BOILER ALARMS
(Safety Water Columns)
FOR SAFER, SURER CONTROL OF BOILER WATER LEVELS
The Reliance Gauge Column Company
CATALOG 414
How to Install the Reliance Alarm Water Column
Reliance Alarm Replacement Parts Order Blank
THE RELIANCE GAUGE COLUMN CO.

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Atlanta, Georgia
Birmingham, Alabama
Boston, Massachusetts
Buffalo, New York
Charlotte, North Carolina
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Denver, Colorado
Detroit, Michigan
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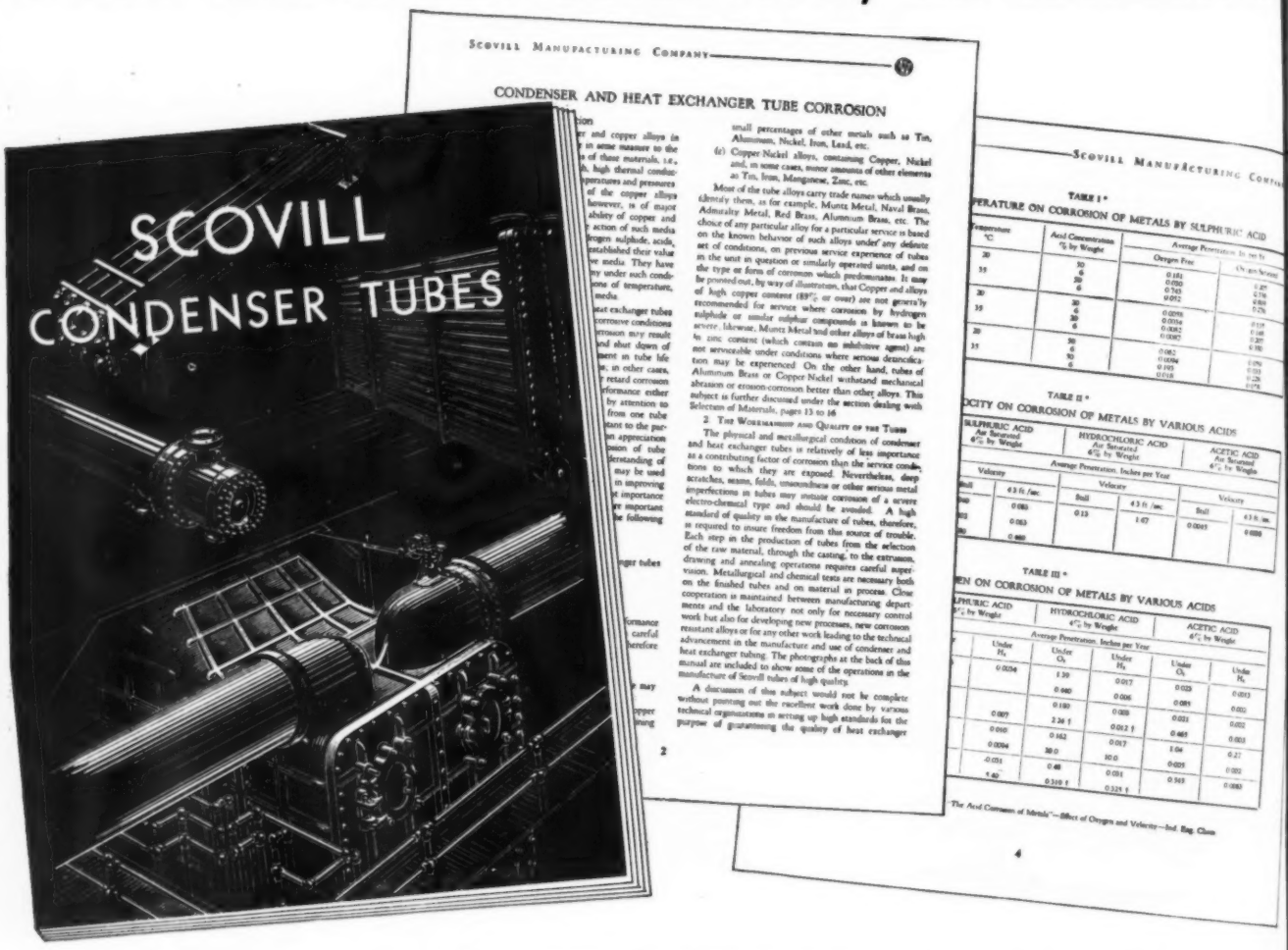
St. Louis, Missouri
Salt Lake City, Utah
San Francisco, California
Seattle, Washington
Tulsa, Oklahoma
Washington, D. C.

THE RELIANCE GAUGE COLUMN CO. • CLEVELAND, OHIO

Scovill Tube News

Vol. 2 SCOVILL MANUFACTURING COMPANY, Waterbury 91, Conn No. 5

New Scovill "Condenser Tube Booklet" Gives Facts On Selection, Installation



Corrosion

The booklet has a color illustrated section on corrosion, as it affects condenser and heat exchanger tubes. Gives the factors that influence tube life — from alloy composition to service conditions. Discusses the six important types of tube corrosion and the corrodants involved. Amplifies on *stress, season* and *corrosion-fatigue* cracking.

Composition of Tube Metals

A separate chapter deals with the composition and physical properties of tube metals such as: Muntz Metal, Admiralty Metal, Phosphorized Admiralty, Red Brass, Deoxodized Copper, Arsenical Copper, Aluminum Brass, 70–30 Copper-Nickel, and 80–20 Copper-Nickel. It gives their nominal composition and the when, why and where of their use in condenser-tube and heat-exchanger fields.

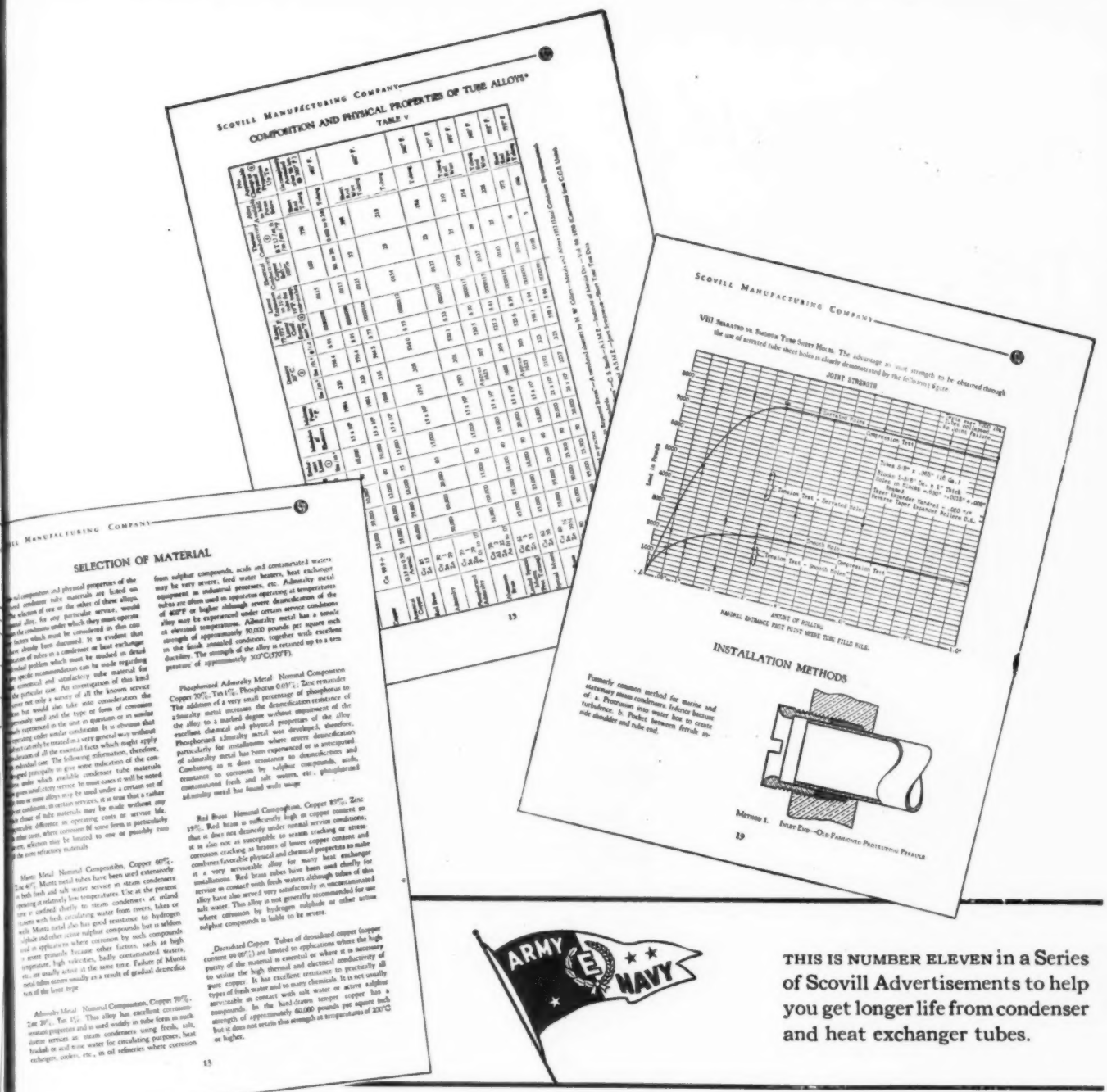
In this new booklet of tube facts, Scovill engineers have compressed a brief of many years of tube experience into some 56 pages. The result is a practical and understandable handbook that tube users will find useful.

Tube Installation

Another section concerns the importance of proper installation, methods of installation, the proper tools. Adequately illustrated with photographs, diagrams, charts and data tables.

Production Methods

Scovill explains the detail of the processes used in tube manufacturing. Thirteen full-page photographs give a good understanding of these processes.



ARMY E NAVY

THIS IS NUMBER ELEVEN in a Series of Scovill Advertisements to help you get longer life from condenser and heat exchanger tubes.

In Conclusion

Scovill's new "Condenser Tube Booklet" provides useful reference pages on Gauge Sizes, Inch Conversion Tables, Temperature Conversion Tables, Per Foot Weights of Scovill Condenser Tubes, Weights of Common Scovill Alloys, Pertinent Formulas and Physical Constants, Heat Unit Terms and Definitions and Conversion Factors with their definitions.

Other Scovill Services

It is by means such as this that Scovill renders its *Service in Manuals*. Other Scovill services include *Service in Metals* and *Service in Men*. The first makes the complete laboratory facilities of Scovill available for the determination of the alloy best suited to your needs. The latter gives you close cooperation from Scovill engineers in planning proper installation or investigation where necessary. Scovill Manufacturing Co., 13 Mill Street, Waterbury 91, Conn.

Scovill
MANUFACTURING COMPANY
WATERBURY, CONN.

SCOVILL CONDENSER TUBES

ONE PRODUCT... THREE SERVICES

Service in Manuals... Service in Metals... Service in Men

Then he said to himself

"THEY CAN NEVER BOMB THIS PLACE"

WITH 300 pound vehemence, Reich-Marshal Hermann Goering once impressed the heilers and the heiled in Berlin with this guarantee:

"THEY CAN NEVER BOMB THIS PLACE"

He was not trying to mislead.

Give him credit . . . he had figured it out as any business man would:

(a) He figured what his competition had

(b) He figured what he had

The answer was simple arithmetic . . . then, departing from arithmetic

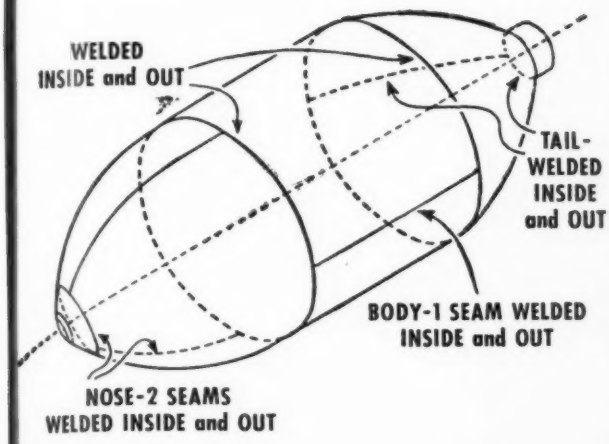
(c) He *estimated* how long it would take his competition to catch up. On *that* he went completely crackpot—unalterably haywire—irretrievably "losing his market" as they say.

And that just proves again that NO ONE can estimate the regular step-ups in output made possible by enthused producers

. . . having recourse to a flexible production technique

. . . that keeps improving regularly.

Listen Hermann, Never say NEVER!



4000-lb. blockbuster, welded as shown in sketch. Its production has been increased by improved arc welding technique.

You're too cagey a rascal *not* to have figured that *recourse* to Arc Welding would speed America's war output. So you estimated that step up at, say, 25%.

But as it turned out, production of Berlin-busters, ships, planes, tanks and guns was stepped up another 25% and then other 25%'s by added recourses applied AFTER your "NO BOMBING" assurance.

And now, the knockout blow

. . . Lincoln introduces the New "*Fleet-Welding*" Technique

recourse to which gives additional step-ups in welding production of 25% . . . 50% . . . 100% . . . and more.

This arc welding technique, developed by Lincoln Engineers, uses *arc force* to get deeper penetration and higher welding speed for all types of joints in mild steel plate, shapes and sheet. Procedure manual with full details will be sent free to engineers and production supervisors.

There is a Lincoln Engineer near-by to assist you in applying the "Fleet-welding" Technique to war production and postwar planning. Call him or write:

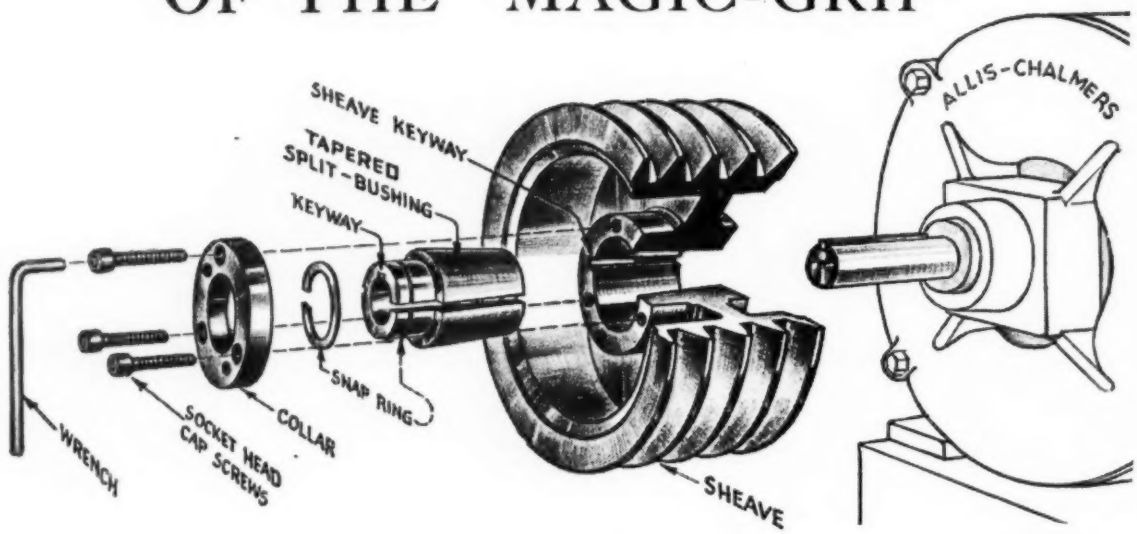
THE LINCOLN ELECTRIC COMPANY • Cleveland 1, Ohio

America's greatest natural **recourse**

ARC WELDING

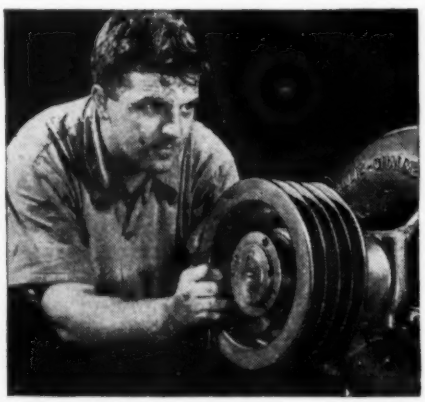
Here's the Secret

OF THE "MAGIC-GRIP"



Exploded view shows why Allis-Chalmers' new "Magic-Grip" Sheave goes on *as a unit in 3 easy steps.* It's the fastest mounting sheave on the market—at no extra cost.

1 **Place sheave on shaft.** Slides on smoothly because clearance is provided by expanded bushing. There's *no* hammering — *no* forcing! Complete sheave and bushing unit comes intact—ready for quick, easy mounting.



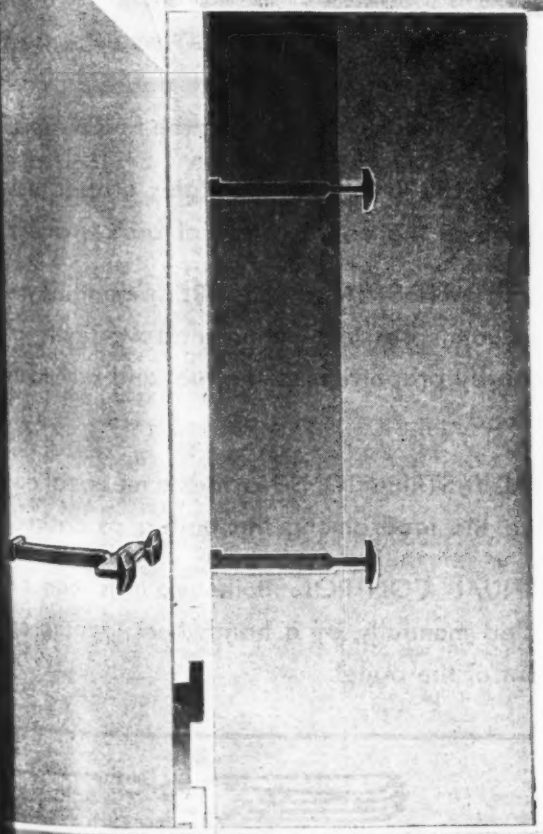
2 **Slide to desired position.** Sliding easily, sheave can be placed *exactly* according to straight-edge . . . giving you true alignment with resulting smooth performance. A minimum of time is required.

3 **Tighten three capscrews** — and it's ready to go! Entire sheave is locked securely to shaft and *grips like magic!* No set screws to damage shaft. Send for Bulletin B6310. Allis-Chalmers, Milwaukee 1, Wis.

A 1764

Allis-Chalmers Texrope

"MAGIC-GRIP" SHEAVES



The principle of integrated design that employes each element for its best function is the result of 30 years' concentration on the one problem of enclosing heat.

Streamlined supporting units tie in the refractories and the insulation yet transfer only a trickle of heat. Detred Tile, intermeshed for tightness, present a smooth front to the fire . . . and plastic outside casing, applied with a trowel, seals the enclosure and provides a weatherproof exterior.

This is the kind of a wall you want now and for post-war production. Learn the details from our 80-page book entitled "Furnace Enclosures," available on request. Let our engineering department check your blueprints for the possibilities of modernizing.

M. H. DETRICK COMPANY
111 W. Washington Street, Chicago 2, Ill.

DETRICK FURNACE ENCLOSURES

USE DETRICK INSULATION . . . PLASTIC or BLOCK

CONSERVE FUEL

and lower your steam cost

Are your boilers delivering the amount of steam you are paying for—or are you being short-changed? An automatic combustion control system, as designed and built by Republic, will enable you to operate your boiler (or boilers) over long periods at *test efficiencies* regardless of variations in fuel, load and other operating factors.

The Republic combustion control is a unified system controlling simultaneously, in measured quantities and in correct proportions, the fuel and air input to the boiler. It increases or decreases the fuel and air supply to the boiler in the correct amount to maintain constant steam pressure and in the correct ratio to maintain maximum combustion efficiency. It not only checks operation but automatically makes necessary corrections of individual factors before faulty operation has a chance to develop.

The difference between such a control and an assembly of uncoordinated regulating devices is comparatively small in equipment but great in principle. Merely to provide automatic operation of a number of individual devices is not enough.

CHECK THESE FEATURES

Built into the Republic combustion control systems are many features that enable it to fulfill all the conditions of theoretically perfect combustion control and still meet all the demands of every-day operation.

Check the following features against your list of "musts" for a perfect combustion control system.

✓ CENTRALIZED CONTROL: The operation and control of the boiler or boilers is centralized at the master controller.

✓ FUEL-AIR RATIO INDICATOR: The master controller is provided with mercury manometers which indicate the measured fuel and air inputs to the boiler and the fuel-air ratio.

✓ FUEL-AIR RATIO ADJUSTMENT: A handwheel on the front of the master control panel provides a convenient means for adjusting the fuel-air ratio.

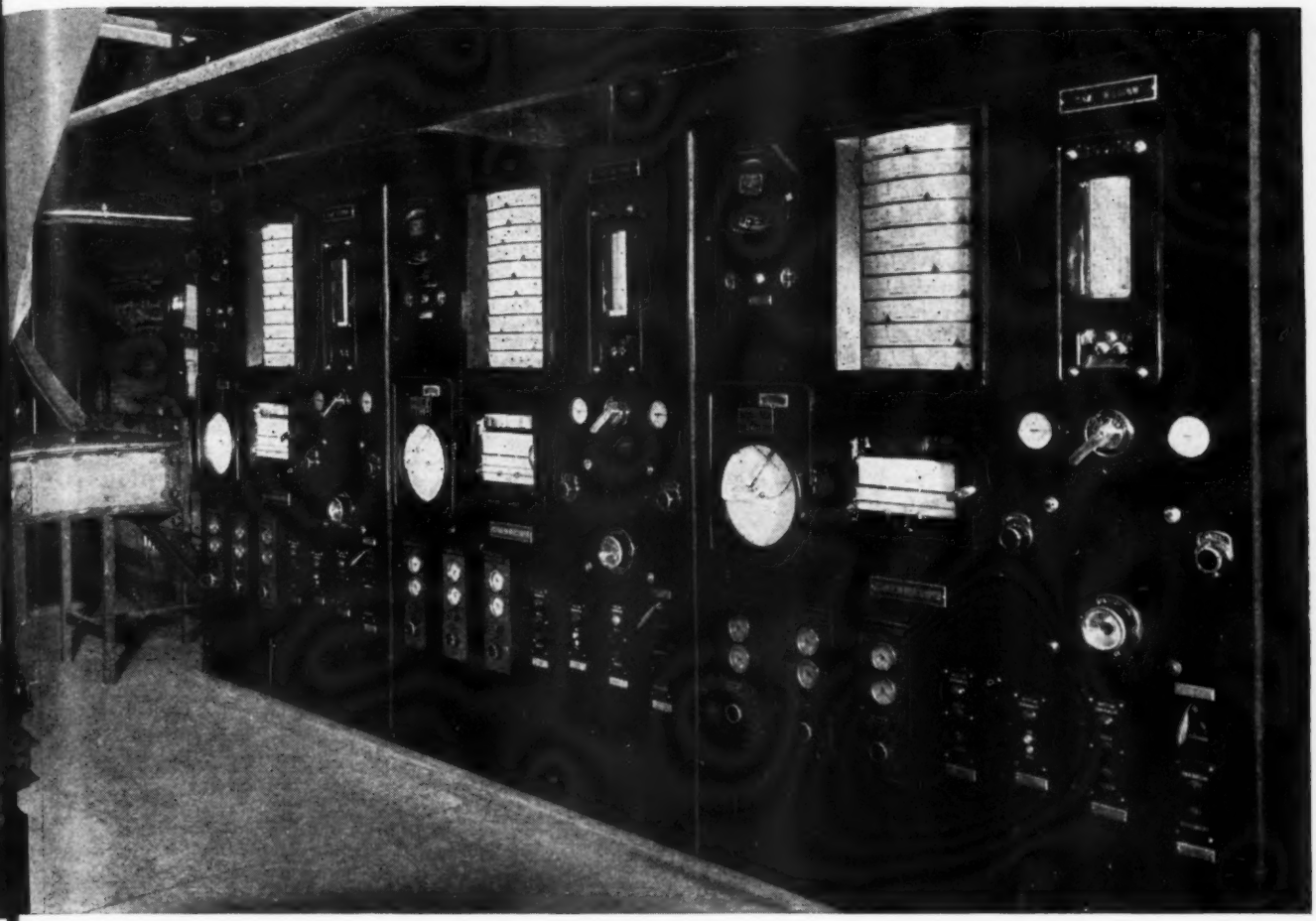
✓ ALL BOILER RATINGS: Maintains proper fuel-air ratio over the entire range of boiler ratings.

✓ CONSTANT STEAM PRESSURE: Maintains the plant steam pressure within narrow limits of variation by proportioning the fuel and air inputs to the load.

✓ LOAD DISTRIBUTION: Provides a means of distributing the load among the boilers as desired.

✓ MANUAL CONTROL: Boiler ratings can be controlled manually by a handwheel located on the front of the panel.

REPUBLIC
INSTRUMENTS
AND CONTROLS



PERFORMANCE FACTS

Here is a list of installation reports, available to you, which present detailed evidence of the savings derived from the installation of Republic automatic combustion control systems in typical boiler plants.

Installation Report No. 43-39
RCA MFG. CO.: 2-125,000 lb. per hr. boilers; 850 lb. pressure, 750 F; pulverized coal or oil fired.

Installation Report No. 51-40
CLINTON COTTON MILLS: 1-70,000 lb. per hr. boiler; 415 lb. pressure, 725 F; pulverized coal fired.

Installation Report No. 60-39
TIMKEN ROLLER BEARING CO.: 1-60,000 lb. per hr. boiler; 400 lb. pressure, 630 F; underfeed stoker fired.

Installation Report No. 70-39
KREY PACKING CO.: 2-35,000 lb. per hr. boilers; 330 lb. pressure; chain grate stoker fired.

Installation Report No. 31-40
SUTHERLAND PAPER CO.: 3-50,000 lb. per hr. and 2-81,000 lb. per hr. boilers; 175 lb. pressure, 450 F; spreader stoker fired.

Installation Report No. 41-40
GODCHAUX SUGARS, INC.: 1-100,000 lb. per hr. boiler; 450 lb. pressure, 560 F; natural gas fired.

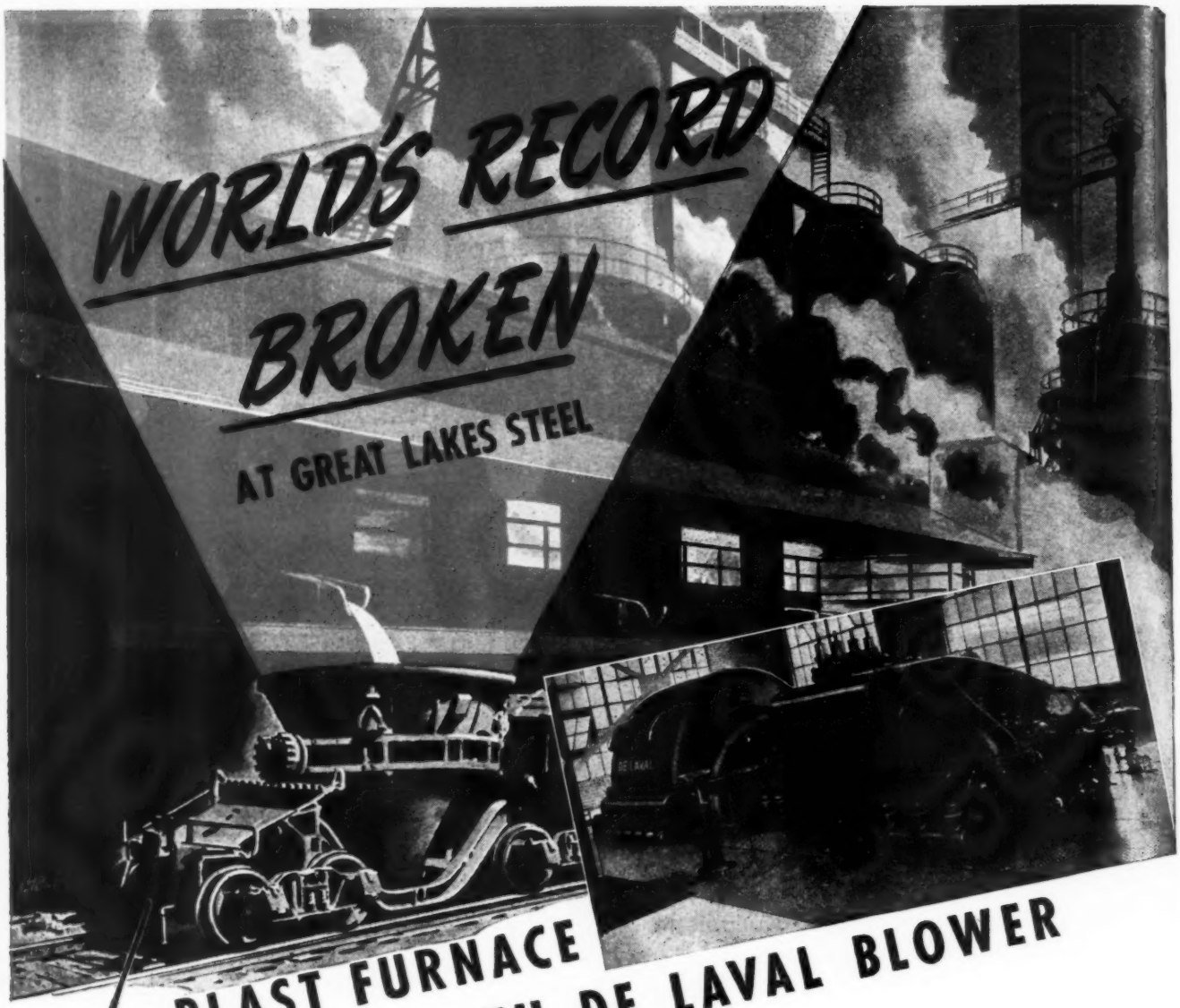
Installation Report No. 61-39
WORCESTER SALT CO.: 1-125,000 lb. per hr. boiler; 200 lb. pressure, 400 F; natural gas or pulverized coal fired.

Installation Report No. 120-39
SWIFT & CO.: 2-45,000 lb. per hr. boilers; fuel oil fired.

All these reports are included in Data Book No. S-21. Write for your copy today. We will gladly mail it to you without obligation.

Republic Flow Meters Co.

2224 Diversey Parkway • Chicago 47, Illinois



by BLAST FURNACE EQUIPPED WITH DE LAVAL BLOWER

All world's records for monthly production from a single furnace were recently broken by "B" Furnace of the Great Lakes Steel Corporation, Detroit. A total of 49,705 net tons of iron were produced in 31 consecutive working days. The tremendous and continuous supply of air required for this record-breaking production was furnished without interruption by an 85,000 c.f.m. De Laval blast furnace blower, which, during the same 31 day period, delivered close to 200,000 tons of air. Aside from routine inspection, this De Laval blower has been in practically continuous service since its installation in 1941.

De Laval turbines, blowers, gears and pumps can be depended upon for uninterrupted service at peak loads, wherever they serve.

M-42

TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS and COMPRESSORS • IMO OIL PUMPS

De Laval

STEAM TURBINE COMPANY · TRENTON 2, NEW JERSEY

SALES OFFICES: ATLANTA • BOSTON • CHARLOTTE • CHICAGO • CLEVELAND • DENVER DETROIT • DULUTH • EDMONTON • GREAT FALLS • HAVANA • HELENA • HOUSTON KANSAS CITY • LOS ANGELES • MONTREAL NEW ORLEANS • NEW YORK • PHILADELPHIA PITTSBURGH • ROCHESTER • ST. PAUL • SALT LAKE CITY • SAN FRANCISCO • SEATTLE TORONTO • TULSA • VANCOUVER • WASHINGTON, D. C. • WINNIPEG

POWER

JULY, 1944 VOLUME 88, NUMBER 7

N O WYNKOOP, *Publisher* P W SWAIN, *Editor*

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A CROSS-INDEX OF SUBJECTS FOR THE MONTH

PLANT OPERATING METHODS, MAINTENANCE AND SAFETY
STEAM GENERATION, FUELS, FIRING AND COMBUSTION
TURBINES, ENGINES, AUXILIARIES; HYDRO POWER
DIESELS, GAS ENGINES AND ACCESSORIES
AIR CONDITIONING AND REFRIGERATION
ELECTRICAL EQUIPMENT, ELEVATORS
PIPING, VALVES AND SPECIALTIES
TRANSMISSION, LUBRICATION
STEAM SERVICES, HEATING
INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

FEATURES

		PLANT OPERATING METHODS, MAINTENANCE AND SAFETY	STEAM GENERATION, FUELS, FIRING AND COMBUSTION	TURBINES, ENGINES, AUXILIARIES; HYDRO POWER	DIESELS, GAS ENGINES AND ACCESSORIES	AIR CONDITIONING AND REFRIGERATION	ELECTRICAL EQUIPMENT, ELEVATORS	PIPING, VALVES AND SPECIALTIES	TRANSMISSION, LUBRICATION	STEAM SERVICES, HEATING	INSTRUMENTS, CONTROLS	PUMPS, COMPRESSORS
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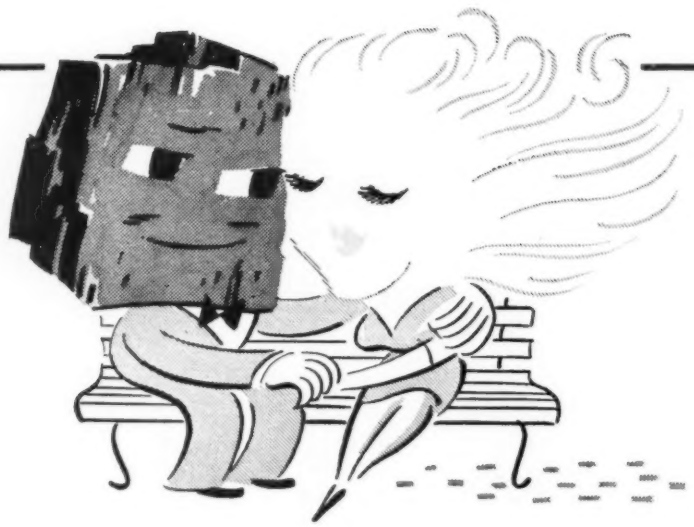
IN A WESTINGHOUSE Link-Grate
coal AND air GET TOGETHER...



The fundamental problem of all firing is to bring together the right amount of coal and the right amount of air at the right time—so that all combustible elements are burned. The most efficient stoker, therefore, is one in which this intimate mixture of coal and air takes place continuously and most effectively.

In a Westinghouse Link-Grate Stoker, an undulating grate surface is synchronized with the coal feed to coordinate the flow of coal and air.

This continuous processing of the fuel results in uniform combustion—not only the Link-Grate surface itself, but also on underfeed section preceding it.

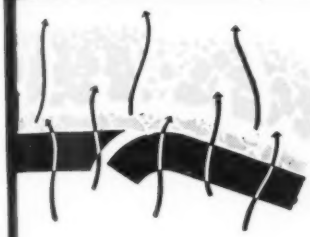
Link-Grate motion improves the entire st performance . . . keeps the bed porous u all conditions . . . the fire sensitive to air . . . burns any grade of bituminous coal e tively . . . But you really have to see a L Grate Stoker installation to appreciate amazing record of daily operation. Just your nearest Westinghouse office for c plete details.

WESTINGHOUSE

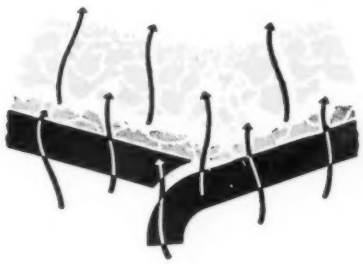
BEFORE YOU BUY...

Look at the Link-Grate

...FOR MORE STEAM PER POUND OF COAL

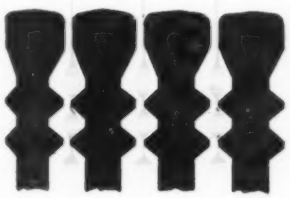


Fuel Bed Processed Continuously

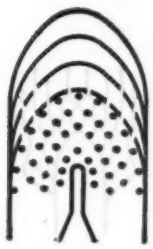


Grates Up—This is the first basic movement of the Link-Grate. It breaks open the fuel bed and thoroughly permeates it with low-pressure air flowing up through the grates. The fused ash in the fuel bed is oxidized and broken into friable pieces.

Grates Down—The second basic movement of the Link-Grate—crumbles and conveys the burning fuel. The fuel bed is kept porous continuously, permitting a uniform flow of gases through the combustion zone. Only low-pressure air is required. This eliminates the need for high-pressure air under the fuel bed and its tendency to blow through the burning coal at thinner spots.



Flow of Air Controlled



Air is controlled in the Link-Grate and tuyerès by projections in each air passage which give the effect of a series of orifices with chambers between. Air passes through the orifices at high velocities, but this velocity energy is largely transformed into static pressure in the chambers. This arrangement provides excellent cooling by air diffusion. It also causes air flow to increase at a lesser rate when fuel bed resistance decreases, protecting grates from the effects of "blowing through".

Link-Grate motion reduces resistance to air flow by keeping the fuel bed porous. Air flowing through the grates is not smothered, but is allowed to support combustion by thoroughly permeating all parts of the fuel bed. J-50450

For more information about Westinghouse Link-Grate Stokers . . . ask your Westinghouse application engineer for Bulletin 3039. Westinghouse Electric & Manufacturing Co., E. Pittsburgh, Pa., Dept. 7-N.

Westinghouse STOKERS

PLANTS IN 25 CITIES ... OFFICES EVERYWHERE

WESTINGHOUSE

BYERS WROUGHT IRON in a NEW STACK INSTALLATION HERE and a "PROGRESS REPORT" HERE

When Westinghouse Electric and Manufacturing Company needed a new stack for the power plant at one of their many works, they didn't need to look far for service data to guide material selection . . . to be specific, only about thirty feet. For the same plant already had a wrought iron stack, five years old and still going strong, which gave an excellent index of the ability of wrought iron to meet the particular corrosive conditions. The new stack was fabricated of ¼-inch Byers Wrought Iron plates by McAleenan Brothers Company.

This Westinghouse experience illustrates a very important point—that any successful answer to the smoke stack problem must come jointly from correct stack design and correct stack material. Carbon dioxide and water vapor are present in all ordinary products of combustion, and sulfur compounds in most. Separated, these are comparatively harmless. But if the stack temperatures fall below the dew-point of the vapor, it condenses, absorbs the carbon and sulfur products, and becomes a highly corrosive acid that gnaws away at any metal.

There's no question but that good design can provide the proper stack height to keep temperatures above the danger point . . . *under anticipated conditions.* But a change in fuels or in period of operation may alter the situation at any time and throw the entire burden of protection upon the stack material. That's why the use of wrought iron is so important.

Experience has shown that wrought iron is one of the best materials for smokestacks, and that it repeatedly out-performs ordinary materials. This superior service is the direct result of wrought iron's unique structure. Fibers of glass-like silica slag, making up two to three per cent of the material by weight, are threaded through a matrix of high-purity iron. These fibers, which cannot be corroded, halt and deflect any attack and force it to spread evenly over the surface, rather than localizing to pit the material. The fibers also anchor the initial protective scale which shields the underlying metal.

You will find a lot of helpful information on stack problems and their solution in our bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment." If you don't have a copy, we will be glad to send you one.

A. M. Byers Company. Established 1864. Offices in Pittsburgh, Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE ALLOY STEELS • OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • JULY 1944 • ESTABLISHED IN 1882

BACK THE INVASION WITH COAL

A THREATENED COAL SHORTAGE gives power engineers everywhere their chance to back the invasion and speed victory. Because they are the most important coal-using group, and professionally skilled in the art of fuel economy, the power men are in the best position to help balance the national coal budget by saving the needed millions of tons.

The figures to be faced make tough reading. Here they are, from the Solid Fuels Administration: estimated 1944 production, 596,000,000 tons; estimated requirements, 626,000,000 tons.

What's to be done about the 30-million-ton deficit? Produce more? Let's hope so, but the prospect isn't bright.

Live off stockpile? The pickings here are mighty poor. These piles have been systematically "robbed" for many months, and are far below normal.

Cut down on space heating this winter in homes, business buildings and factories? Probably "yes"; the rationing of discomfort will likely come. Many will shiver, and coal will be saved thereby, but not enough.

Wherever you start this study you always end up with the hard fact that somewhere between 200 and 250 million tons of bituminous coal will be burned this year under the direct supervision of power engineers to generate steam in the boilers of central power stations, industrials, large buildings and institutions. They burn this coal, and only they can save it.

For every power engineer this personal assignment has two parts. One is to set his own house in order—check his coal-burning equipment for efficiency *and its ability to handle any available coal* (because plants won't have free fuel choice), make baffles and furnace walls tight, keep boiler tubes clean, watch excess air and flue temperature, train and supervise firemen, plug steam leaks, repair heat insulation, check traps, eliminate every waste in the generation and transmission of steam, electricity and the other power services.

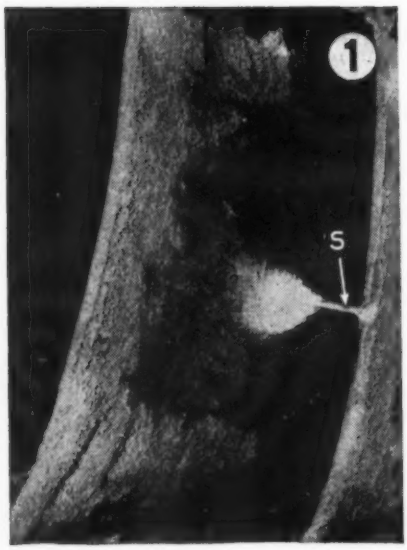
The other half of this fuel-saving job is spelled "teamwork": Cooperate with your regional engineer of the National Fuel Efficiency Program, with the proper committees of your engineering societies, with those top executives of your company who will surely be on the spot to save fuel while maintaining war production, with factory foremen to cut waste in power-service applications.

The time to start all this is today. The coal you save now will live to fight another day, to keep production rolling right through 1944, to energize the vital services of electrical power, water supply and transportation—to make essential steel—to keep every needful thing flowing without pause to the boys who are fighting our battles on the invasion fronts of Europe and all around the globe.

Electric Welding Repairs Pitting On

By ERIC F BLADHOLM

Mechanical Engineering Dept, General Plant Div, Dept of Water and Power, Los Angeles, Calif.



Report submitted to Jas F Lincoln Arc-Welding Foundation in its $200,000 Industrial Progress Award Program on arc welding applied to design, fabrication, construction, maintenance. In a 2½-yr study, 408 awards indicate a possible saving by arc welding of nearly two billion dollars, including seven million tons steel at 271 million dollars and 153 million man-hours.

► MAINTENANCE of Los Angeles' power system by the Dept of Water and Power involves some of the largest problems of their kind. Total connected generating capacity is about 800,000 kw, of which 495,000 are represented by six 82,500-kva hydroelectric generators at Boulder Dam power plant. The first unit began operation Oct, 1936.

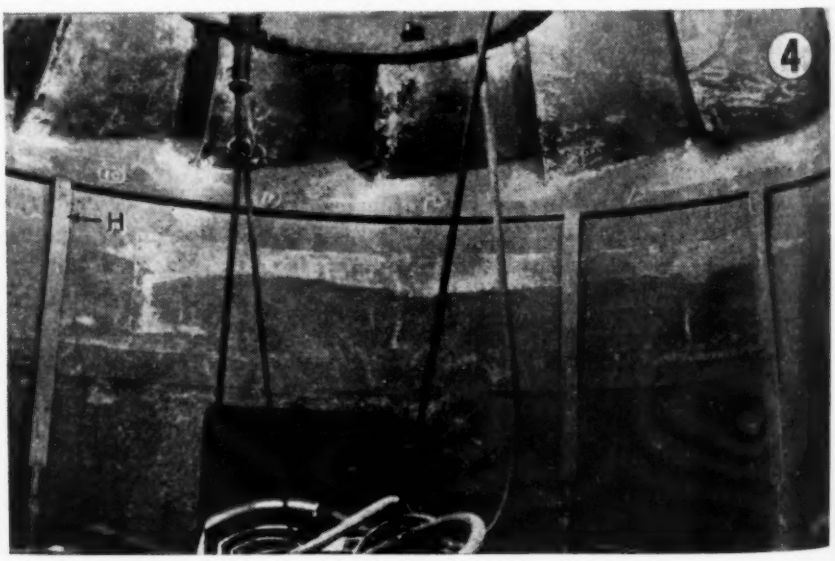
Hydraulic-turbine runner maintenance was started in 1938 by the general-plant-division shops. Up to the time of writing this article, a total of 31,566 sq in. of surface pitted by cavitation has been repaired. Of 3460 lb of welding rod used, 2735 lb was mild steel; 650 lb, 18-8 stainless; and 75 lb, 4-6 chromium. Repairs required 12,577 man-hours. In line with the operating division's policy, a high standard of continuity service has been maintained with minimum outage.

Turbine runners are francis design, developing 115,000 hp at 2500 cfs and 500-ft head. Diameter is 15.5 ft, weight 75,000 lb. Made of cast steel, they contain 0.32 carbon, 0.35 silica, 0.70 manganese, 0.025 sulphur and 0.025 phosphor.

Inside diameter at draft-tube top of runner is 11 ft, which allows ample working space. Each unit has 19 guide vanes, which are about 39 in. high from the draft-tube side and 1 in. thick at the trailing edge. Fig. 4 shows a view of the runner from the draft tube.

From Oct, 1936, when unit N-2 went in service, periodic inspection during operation disclosed cavitation of the units. After four to six months, only minor pitting had occurred in low-pressure areas of runner vanes near their trailing edge. Areas were small with a maximum depth of about $\frac{1}{32}$ in. During this time, turbine head increased from 378 to 450 ft. Because operation

Fig 1—Cavitation on all four units varied in intensity, but in general was as here shown, except on the trailing edge of some vanes, which were cavitated through. Fig. 2—Round-nose chisels, ¼- to ½-in. wide, made parallel cuts to a uniform depth to remove cavitated metal. Fig. 3—An air-driven milling cutter was also used to remove metal from pitted areas. Fig. 4—Working platform in the draft tube under the runner was supported on adjustable hangers, *H*



Boulder Dam's 115,000 Hp Turbines

Areas pitted by cavitation on the runners of four hydraulic turbines, developing 115,000 hp at 2500 cfs and 500-ft head, were repaired by electric welding. In treating 31,566 sq in. of pitted surface, 3460 lb stainless-steel, mild-steel and chromium-steel welding rod were used

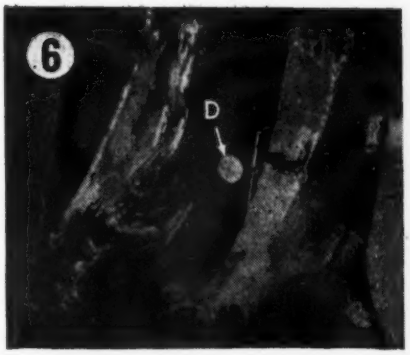
was noisy at the low heads, the manufacturer installed vane struts, Fig. 1, but a few months later they were removed.

In Feb. 1938, 16 months after unit N-2 went in service, cavitation was propagating so fast that an extensive repair program was planned for the approaching low-peak season. Cavitation on N-1, N-3 and N-4 was similar in extent to that on N-2, but varied in intensity, Fig. 1. In places the vanes, 1 in. thick at the trailing edge, were cavitated through. At the increased cavitation rate, it was evident that by the next winter, operation would damage the units seriously.

Time did not permit much experimenting or testing. Good suggestions were obtained from similar jobs, but our program being much larger differed in many respects. The general-plant-division's engineering and shop sections cooperated in laying out equipment, materials and methods to make repairs.

Qualification was not a problem because welders were qualified periodically and many good ones were available. Best repair methods were developed by making test plates. Vertical plates set up to simulate actual field conditions were chipped in steps of one welding bead. Chipping methods and tools like those used at Safe Harbor Plant, Safe Harbor Water Power Corp (POWER, March, May and June, 1937) were satisfactory. Various types of welding rods were tested to determined bonding and deposition characteristics. Current and potential settings were also noted for the different rods. Deposited metal was peened and then ground to determine its grinding characteristics and the best grinding wheels and tools for resurfacing.

These test plates determined the shop men's ability to chip, weld, peen and grind, and in addition served for dem-



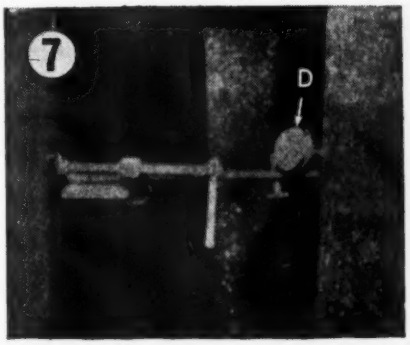


Fig. 5—Milling machine with air-driven head was built to remove pitted metal. Fig. 6—Before starting welding a dial indicator and thermometer, *D*, were mounted on one vane and distortion and temperature noted as welding progressed. Fig. 7—Dial indicators, *D*, were placed 90 deg apart and feeler-gage reading taken. Fig. 8—Cup grinding wheels finished welded surfaces. Fig. 9—Primary object of milling machine was to get an even surface to deposit welding metal

onstration and training new men. A full-sized floor plan of the runner area was laid out in the shops to determine how many could work on it efficiently.

A wood staging, Fig. 11, was so constructed that it could be readily installed through the draft-tube inspection doors without sacrificing strength. This platform was set at an elevation so the men could conveniently work on the vanes and still get out of the inspection doors easily in an emergency. Foot benches were of varying heights for both tall and short men. Portable power switchboards, drop cords, welding leads, grounding cables and miscellaneous wiring were installed. A master switch in the draft tube, Fig. 12, permitted shutting down ventilation and welding machines in emergencies.

Considerable study was given to ground connections for welding operations. To prevent a heavy current flow from turbine shaft to guide bearings, the runner and draft tube were both grounded with 500,000-cm cable. We also welded a 0.25x2-in. mild-steel strap between runner and discharge ring. Grounding cables and other wires were passed in under the platform and up through holes in its center under the runner cone. The master switch we attached to the runner cone within convenient reach.

Two blowers forced ventilation air into the draft tube through the inspection doors and a fan exhausted through a manhole in the scroll-case top. These provided plenty of fresh air with sufficient draft to pull grinding-wheel dust out of the working area. Space heaters placed in the manways leading to draft-tube inspection doors heated the ventilating air when needed.

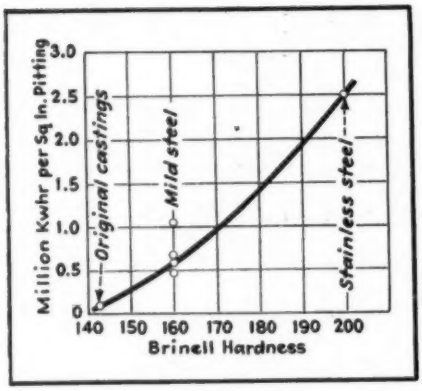


Fig. 10—Comparison of the wearing qualities of the original metal with welded mild and stainless steels

Two 1-in. air hoses passed into the draft tube under the platform connected to manifolds having five ½-in. air-hose connections, used for chipping, peening and grinding. Helmets with safety glass windows and gloves were provided for grinding. The helmets protected the operator's face and neck from grinding particles. Chrome-leather aprons, gloves and shoulder protectors shielded the welders. Conventional helmets and extra-light electrode holders were used. Stools had adjustable legs and arm rests, and everything practical was used for comfort and safety. Grinder pedestals had telescopic legs to adjust their height readily.

The men used an eductor galley bay to change clothes and eat meals. This room, large enough to store tools, supplies and equipment was conveniently located to all units repaired. Minor repairs and adjustments to equipment were made here although chisel tempering and a small amount of other work were done in the main-plant shop. Two table grinders near the draft-tube inspection doors were used for dressing the hand tools.

Our chipping methods were similar to those at Safe Harbor. Round-nose chisels ¼ to ½ in. wide made parallel cuts ½ to 1 in. apart through the pitted areas, Fig. 2. Cuts uniform in depth gaged removal of remainder of cavitated metal. Cut depth could be controlled more closely with a round-nose chisel than with a cape chisel. Areas between ½-in. furrows were chipped out with ½- to 1-in. flat and cape chisels. All cavitated areas were chipped down to sound parent metal.

Good chippers were scarce and at first it was hard to get an even welding surface. However, chipping improved with experience and personnel selections. On the first unit, N-1, chipping required 0.08 man-hours per square inch, but was reduced to 0.06 on a later unit. Except small amount of overhead chipping on the top ring, all chipping was vertical, or nearly so.

During the repair work, a milling machine, Fig. 5, was built and tried on unit

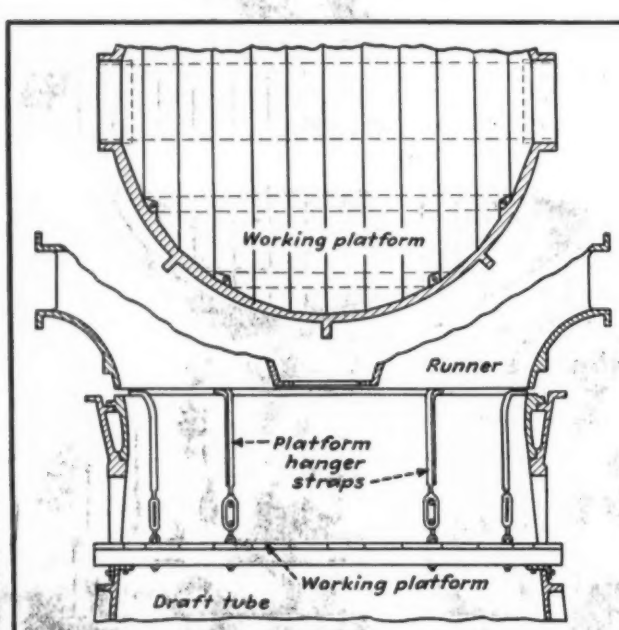


Fig. 11—A wooden platform was so constructed that it could be installed through the draft-tube inspection doors and set at an elevation for men to conveniently work on runner vanes

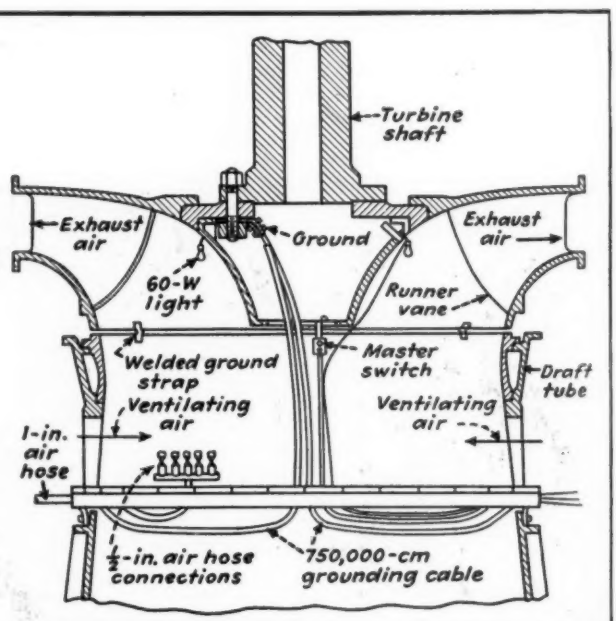


Fig. 12—Ground cables and other wires were brought up through the center of the platform. A master switch near the runner cone permitted cutting off all power in an emergency

BOULDER POWER PLANT LABOR DISTRIBUTION ON CAVITATION REPAIRS

OPERATION	*Unit N-1* Man-hr	*Unit N-1* Man-hr per sq in.	*Unit N-4* Man-hr	*Unit N-4* Man-hr per sq in.	*Unit N-2* Man-hr	*Unit N-2* Man-hr per sq in.	*Unit N-3* Man-hr	*Unit N-3* Man-hr per sq in.	*All units* Man-hr	*All units* Man-hr per sq in.
Chipping	586	0.08	644	0.06	240	0.08	120	0.06	1590	0.07
Machining	...	....	...	.....	160	0.04	96	0.07	256	0.05
Welding	794	0.11	784	0.07	678	0.10	306	0.09	2562	0.09
Peening and grinding	773	0.11	448	0.04	468	0.07	232	0.07	1921	0.07
Electrical	394	0.06	176	0.02	168	0.03	224	0.07	962	0.04
Misc	1023	0.15	880	0.08	788	0.12	288	0.09	2979	0.11
TOTAL	3570	0.51	2932	0.27	2502	0.44	1266	0.45	10,270	0.43
Area sq in.	7000		10,600		6670		3300		27,570	
Welding rod wt	596[a]		1,175[b]		1000		350		3,121	
Man-hr welding per lb	1.3		0.67		0.68		0.87		0.80	
Date	4-7-38		5-15-38		6-27-38		8-14-38			

[a] — 546 lb 18–8 stainless-steel rod, 50 lb mild-steel rod
[b] — 70 lb 18–8 stainless-steel rod, 1030 lb mild-steel rod, 75 lb 4–6 chromium rod

Subsequent welding on these four units to the end of 1940 required 2307 man-hr and 339 lb of welding rod. All welding required 12,577 man-hr, 3460 lb of welding rod on an area of 31,566 sq in. The 3460 lb of welding rod includes 2735 lb of mild steel, 650 lb of 18–8 stainless steel and 75 lb of 4–6 chromium welding rod.

N-4. Its milling head is driven by an air motor and has an adjustable feed for accurate and rapid adjustment of cut depth and to release the cutter in emergency. Cuts are made, Fig. 3 and 9, in even steps, approximately ⅛-in. deep, so that welding layers can be laid uniformly and grinding done faster when finishing the surface. Small sections of cavitated metal, which still existed after the milling operation, were chipped out to sound parent metal.

In addition to giving an even surface metal could be removed by the milling machine in 0.04 man-hours per square inch, compared with 0.06 to 0.08 by hand chipping.

During welding, consideration was given to established practice of our department, of water and power and of industry. The hydraulic-turbine manufacturer was consulted and a method of repairs developed which was satisfactory to all interested. Shop tests were also closely studied. As a result, a close overlapping bead was laid on, so that a minimum of patch welding would fill valleys between beads left after grinding. Studding was not practical, but good fusion was obtained with the cast-steel runner.

Five-man crews were used on each welding shift, the welding being coordinated with chipping and grinding. Each repair job started with chipping, and, as the work advanced, welding and then peening and grinding. Crews were rotated so that no work phase had to wait.

Each runner was divided into four sections and only one welder worked at one time on each section, the fifth being a relief man. Metal partitions, painted black, separate the welders working on the runner. Four 200-amp dc welding machines were used, extreme care being taken to avoid distortion or overheating of runner sections. Before welding was started on a runner, a dial indicator and thermometer, Fig. 6, were mounted on one vane and distortion noted as welding progressed. Warping was found negligible if section welding progressed from vane to vane to allow the heat to dissipate.

Dial-Indicator Measurements

Two dial indicators were also placed 90 deg apart on the runner vane tips, Fig. 7, and feeler gage readings taken at each point, to obtain clearance between stationary and runner wearing rings. At first, readings were taken every half hour, but when no distortion was found, once every hour. The dial indicators showed 0.001 to 0.002 in. variation, but this probably was not caused by welding because the change coincided with a change in scroll case temperature as the penstock was being filled.

Tram marks were made on the lower flange face of the runner cone and on the center trailing edge of each vane about 3 ft away. These marks also checked the distance between vanes and runner cone so that warping, if any, could be detected. Later, the long tram was discarded and a shorter 5-in. one checked the distance from one vane edge to an adjacent one in about the same location the struts previously occupied. Measurements at this point, using the short tram, showed a maximum deflection of 0.025 in.

Unit N-1 was repaired with an austenitic 18-8 (18% chromium, 8% nickel) stainless-steel coated rod, having 0.07 maximum carbon and a columbium to carbon ratio of not less than 10. Test samples were not made, consequently tensile strength and ductility are not known. Stainless-steel rod was laid on with a close overlapping bead and gave a smooth, bright polish after grinding operations.

Before applying the stainless-steel rod, all deeply chipped areas were built up with a mild-steel rod. Welding beads were laid on horizontally, and all succeeding layers applied parallel to the underlayers. After applying each welding-bead layer, beads were carefully wire brushed and peened. Low areas were built up to within not more than 0.1 in. of the final contour as determined by templates. A minimum thickness of 0.1 in. was maintained for the stainless-steel layer, which was applied last.

There was a slight tendency for undercutting at the edge of the chipped areas when using 18-8 rod. This resulted from porosity and sand holes in the parent metal, corrected by running a mild-steel bead along the edge of the chipped area before the stainless steel rod was applied.

(*Continued on page* 136)

For a More Economical Power Rate Try Retiming Intermittent Loads

B J George, industrial engineer, tells why prevailing rate charges vary with operating needs and how to schedule power demands for smallest over-all cost. You can put these metering methods to good use if you generate power and charge each department for service

In June, 1944, POWER, *Mr. George classified power-cost fundamentals under fixed and variable units in "Classify Your Power Costs." Here he explains various rates by which utilities charge for power demand and energy consumption. Understanding how these work will help the engineer schedule his operations to reduce power bills.*

► UTILITIES are often criticised for their so-called complicated rates, sometimes justly so, but by and large the terms and their application are easily grasped by studying rate-structure fundamentals. Their representatives are glad to discuss rates and how to operate more efficiently under them. Learning to apply a particular power rate certainly is no more difficult than many of the operating engineer's other duties.

If all utility units of service were alike, and if all consumers purchased and used them identically, service charges would indeed be simple. Only a flat rate per unit would have to be charged.

But consumer requirements vary in quality and continuity of service, maximum demand, time of demand, and number of hours of use. Thus, one consumer requires 100 kw at the time of system peak loads, purchases 12,000 kwhr per month, and must have the higher quality service then available.

Another consumer demands only 50 kw and uses only 25 kw during system peak loads. While he also uses 12,000 kwhr per month, he is largely satisfied with unregulated power service. Obviously, the latter customer is entitled not only to a lower total power cost but also to a rate that gives a lower net cost per kwhr.

To bill each customer on the same flat rate per kwhr or even kw of demand is not equitable. This is why electric-utility schedules contain different rates, some of which apply to several classifications of load requirements, and others to a single classification.

Charges are first classified as *flat* and *meter* rates. Flat rates are simplest, being a flat charge per lamp, horsepower or installation. They are becoming less common, except for street lighting where an annual or monthly charge is made for a particular size and type of lamp operating a specific number of hours per year. Except in such cases, the flat rate leads to wasteful habits.

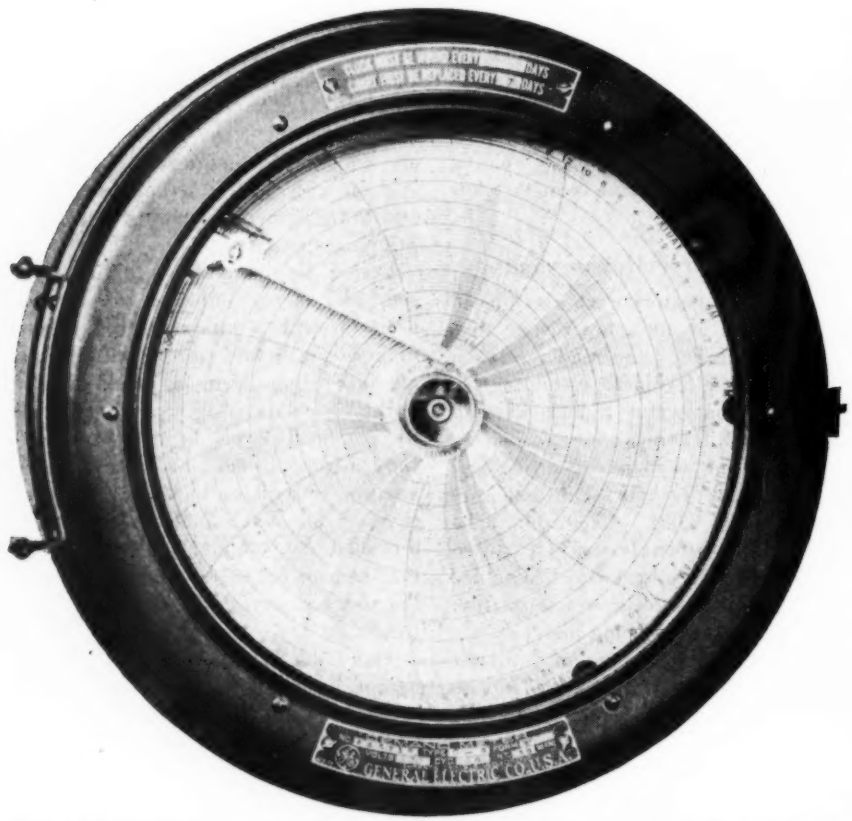


Fig. 1—Chart readings multiplied by a constant equals the average kw demand over a specific period. The meter has a seven-day chart and records the average demand for a thirty-minute interval

Courtesy of General Electric Co.

Energy and Demand Rates

Meter rates are classified into *energy-meter* and *demand-meter* rates. The energy-meter registers the energy, or kwhr, while the demand-meter registers the demand in kw (or it may be expressed in hp or kva) both services being billed on some basis. The term *demand rate* is often applied to any form of charge based upon, or a function of, the extent of use, size of the consumer's installation, or the maximum demand during a given period. Demand may be in kw, kva or hp.

Energy-meter rates are based on quantity while demand-meter rates are based on demands of quantity. For instance, a kwhr or hphr represents quantities of energy, while a kw or hp represents demands for power. Both energy-meter and demand-meter rates may be of the flat variety. For example, a charge of 5¢ per kwhr is a flat energy-meter rate

(sometimes called a straight-line meter rate) while a charge of $36.00 per year per kw of demand is a flat demand-meter rate.

A study of service costs indicates that, as the number of energy or demand units increase, cost per unit produced may drop; hence the flat meter rate should be modified to make it equitable. To take into account this decreasing cost, step- and block-rate elements are introduced. They may be applied to either demand-meter or energy-meter charges.

Step and Block Rates

Whether the step meter rate is energy or demand, a specified charge per unit is made, the price depending upon the step in which the particular consumption, or demand, falls. Thus a rate may be set up for consumption per month of:

1 to 50 kwhr—8¢ per kwhr
51 to 100 kwhr—6¢ per kwhr.
101 to 500 kwhr—4¢ per kwhr
Over 500 kwhr—3¢ per kwhr

Such a bill is easy to figure since it is necessary to determine only in which steps monthly consumption falls and to multiply by the unit charge. It is independent of demand, and is designated as a *step energy-meter* rate. Similarly, a *step demand-meter* rate may be set up with unit-demand charges decreasing in steps.

In the block meter rate for energy or demand, total consumption or demand is divided into blocks; a specified unit charge is made for the first block, then a lower unit charge for each succeeding block.

Thus a *block energy-meter* rate may be set up per month:

First 50 kwhr —8¢ per kwhr
Next 50 kwhr —7¢ per kwhr
All over 100 kwhr—4¢ per kwhr

Similarly a *block demand-meter* rate may be set up per month:

First 10 kw —$10.00 per kw
Next 25 kw — 9.00 per kw
Next 65 kw — 7.00 per kw
All over 100 kw— 6.00 per kw

If the average rate per kwhr is plotted vertically against the total monthly consumption, the resulting curve is a horizontal straight line on the flat meter or straight-line rate and a descending stair-step curve on the step meter rate; hence the names. The term, block, is often erroneously used for step.

Many years ago it was recognized that even metered step or block rates were not entirely satisfactory, because they did not take into account all elements entering into the service cost, and hence were inequitable or did not encourage economy in producing and using electric energy. A step or block meter rate based solely upon the quantity of energy or kwhr delivered takes no account of the fact that, other things being equal, two consumers having different demands but using the same number of kwhr per month ought to pay different amounts since the fixed service costs are different. The Wright maximum-demand rate remedies this defect.

Here a maximum price per unit is charged for a certain amount of energy, and one or more reduced prices per unit for the balance, on the block principle; the number of units in the various blocks being determined from the maximum demand. To illustrate:

First 60 hr —6¢ per kwhr
Next 100 hr —5¢ per kwhr
All over 160 hr —3¢ per kwhr

Assume a consumer with a maximum demand of 20 kw and a consumption of 3600 kwhr per month, the bill would be:

First	60 x 20=1200 kwhr x 6¢=	$ 72
Next	100 x 20=2000 kwhr x 5¢=	100
Balance	= 400 kwhr x 3¢=	12
	Total bill	$184

Another rate frequently encountered is the Hopkinson demand rate which has two main charges based upon (1) maximum demand and (2) energy consumed. The rate often is used with flat meter form in both the demand and energy elements, in which case there is

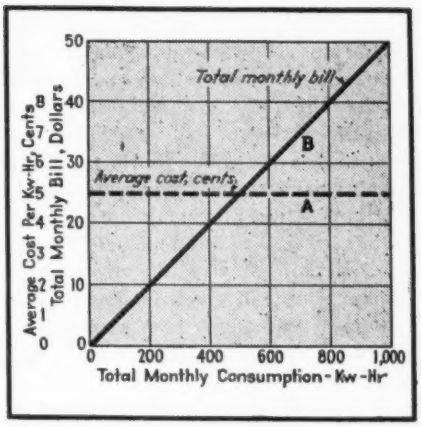


Fig. 2—Flat energy meter rate or straight-line meter rate produces a straight-line curve of total monthly cost plotted against kwhr consumed

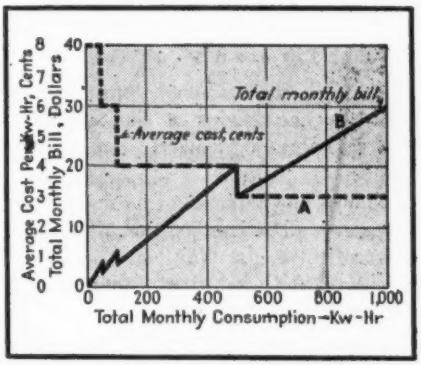


Fig. 3—Graphical representation of step energy meter rate, which produces stair-step curve of cost per kwhr. Step is often confused with the term block

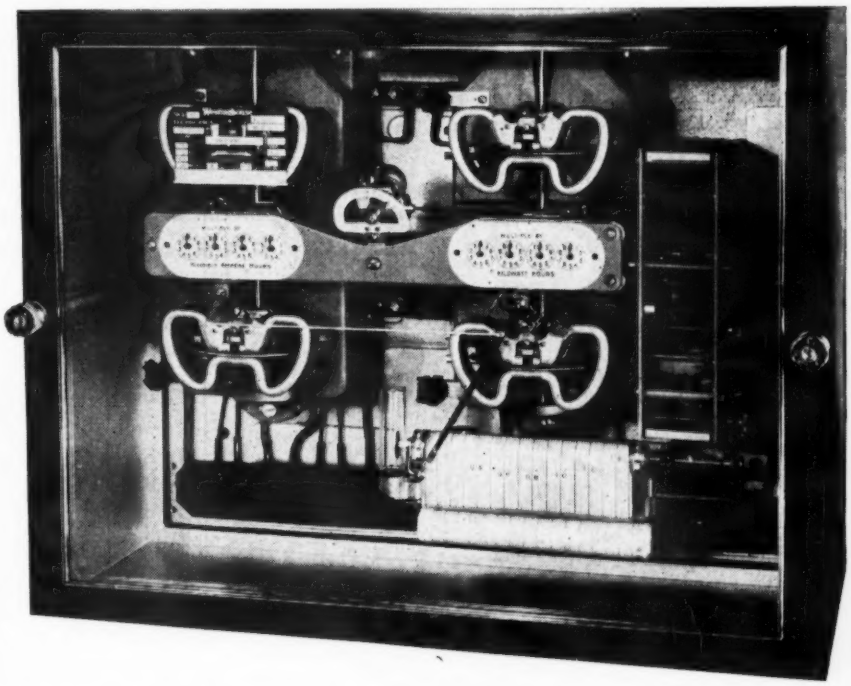


Fig. 4—Recording kilowatt-ampere demand meter, that registers kwhr and kva hr on the dials and kva demand on the chart, and which marks the chart at regular intervals to indicate the kw demand —*Courtesy of Westinghouse Electric & Manufacturing Co.*

but one flat unit charge per kw of demand plus one flat unit charge per kwhr. In other cases either one or both of the elements may be stepped or blocked, while in still others one is stepped and the other blocked. Often the energy charge is divided into blocks determined from the maximum demand similar to the Wright maximum-demand rate. Here is an example of a block Hopkinson rate in which demand charge is blocked and energy blocks are determined as in the Wright maximum-demand rate:

Demand charge, use per month:
First 100 kw —$1.75 per kw
Next 200 kw — 1.50 per kw
All over 300 kw— 1.25 per kw

Energy charge, use per month:
First 120 hr —1.2¢ per kwhr
Next 120 hr —1.0¢ per kwhr
All over 240 hr—0.8¢ per kwhr

The Doherty, or 3-charge rate, essentially is one having a flat customer charge, plus a demand and energy charge.

Almost any rate falls into one of the foregoing, or a combination of two or more of them. In addition, the specific rate may, and often does, contain other provisions, including clauses for (1) minimum demand and minimum bill (2) quantity discounts (3) prompt payment discounts or penalties (4) fuel (5) power factor (6) restricted operation (off and on peak) and (7) tax and inflation.

Another variation is in establishing the maximum demand for billing purposes. Sometimes it is reestablished each month while at other times it is maintained for some definite period, say one year, unless exceeded in the mean-

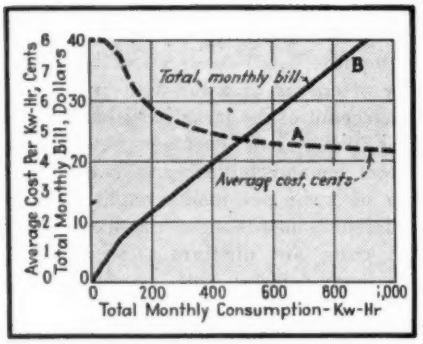


Fig. 5—Block energy meter rate produces a smooth curve of cost per kwhr

time. Maximum demands may be the average over a 15- or 30-min. period, or some other time interval, or it may be based on a single peak or the average of two or more peaks.

The question now arises, "How may a consumer take advantage of these rates to purchase power most economically?" Generally, by knowing the features of the power rate and how plant operation affects energy consumption and maximum demand. If the operation causes excessive demands, and if the service charge is a flat or straight-line meter rate, obviously the excessive demands do not affect power cost except as it tends to increase the kwhr used. Hence, if the excess demand exists only a short time, say an hour a day, the effect may be negligible.

If, on the other hand, the charge is based on demand, say on the Wright or Hopkinson demand, an increase in maximum demand for short periods may increase power cost materially. In the Wright system more kwhr are billed at higher blocks of the rate, whereas in the Hopkinson both the demand and energy charges are increased for a given kwhr per month.

A specific job, say pumping water, requires a more or less definite quantity of energy which may be applied at a high rate for a relatively short period, or at a lower rate for an extended period. Often, by driving the pump at a lower speed the demand in kw may be reduced, bringing about a marked decrease in power cost. Of course, before making this change take into account all factors, especially the relation of this particular operation to the rest of the load and the effect upon total power demand.

Suppose two condensing-water pumps are available, a large one for summer and a smaller one for winter use. Determine whether it is more economical to run both pumps in summer to reduce head pressure on the refrigerating compressors and the power necessary to drive them. Here are the problems involved: (1) Does the condenser system use the added water economically? (2) What is the actual reduction in power demand and consumption of the compressor motors? (3) What is the increased power demand and consumption of the condensing-water-pump motors? (4) What is the net increase or decrease in the combined power demand and consumption for both compressor and pump motors? (5) How does it affect the power bill, month by month; is the demand charge reflected in the bills throughout the year, or does it have no effect at all? (6) What is the change in kwhr consumption, and what is the total saving in power cost? The same analysis may be applied to using the large rather than the small pump during winter. (*Continued on page* 144)

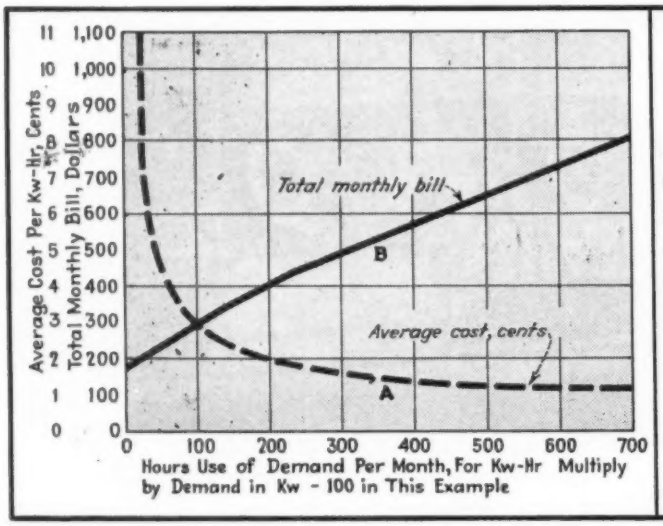

Average Cost Per Kw-Hr, Cents
Total Monthly Bill, Dollars
Total monthly bill
B
A
Average cost, cents
0 100 200 300 400 500 600 700
Hours Use of Demand Per Month, For Kw-Hr Multiply by Demand in Kw - 100 in This Example

Fig. 6—Graphical representation of the block Hopkinson energy rate and demand-charge curve of cost per kwhr

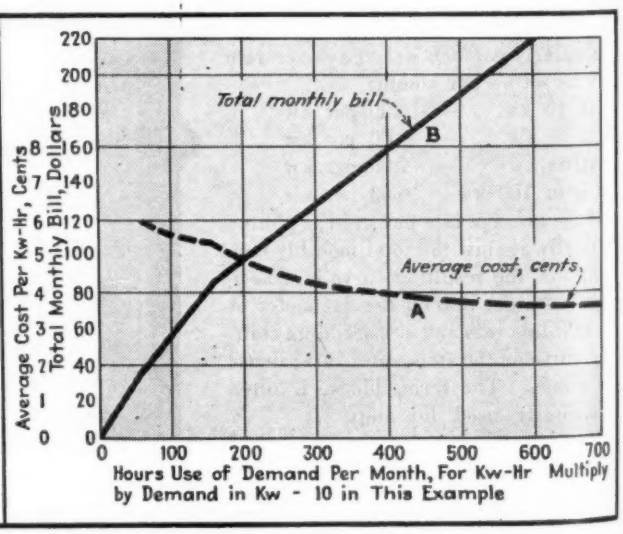
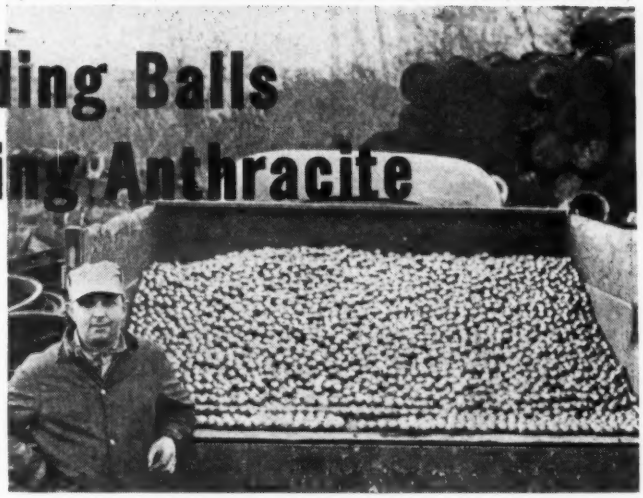

Average Cost Per Kw-Hr, Cents
Total Monthly Bill, Dollars
Total monthly bill
B
A
Average cost, cents
0 100 200 300 400 500 600 700
Hours Use of Demand Per Month, For Kw-Hr Multiply by Demand in Kw - 10 in This Example

Fig. 7—Wright maximum demand with energy-rate blocks based on a specified number-of-hours use of demand per month

Alloy Cast-Iron Grinding Balls Cut Cost of Pulverizing Anthracite

By C H FRICK
Plant Betterment Engineer, Pennsylvania Power & Light Co



Grinding balls are made from a white cast iron, alloyed with 4.5% nickel and 1.5% chromium to give high hardness

▶THE PENNSYLVANIA POWER & LIGHT Co, located as it is in the heart of the anthracite fields, is the world's largest single consumer of this type of coal. In the culm banks of this area there are available millions of tons of raw coal too small for stoker consumption and formerly considered waste by coal companies. The power company has been a leader in research to adapt this fine-sized fuel to electric power generation. As early as 1924, tests demonstrated that it could be used for pulverized firing. The Pine Grove Station was first fired by this fuel in 1927, and now consumes about 225,000 tons per yr of the so-called prepared slush, or culm.

Since this grade of anthracite bears a high ash content (14 to 16%) and is by nature more difficult to pulverize than bituminous coal, engineers search constantly for ways to reduce grinding costs. To this end the company instituted a test in 1941 to determine whether some grinding ball other than the customary heat-treated forged-steel product might reduce cost.

The excellent performance of hard abrasion-resistant Ni-Hard* cast iron, in the form of roll heads, mill liners and ash pipe in power plants, led to the selection of grinding balls of this composition as a likely candidate to effect such a saving. Of white cast iron alloyed with 4.5% nickel and 1.5% chromium to produce a high hardness of 550 to 650 Brinell, this material is considerably stronger and tougher than unalloyed white cast iron, which has a hardness of 400 to 450 Brinell.

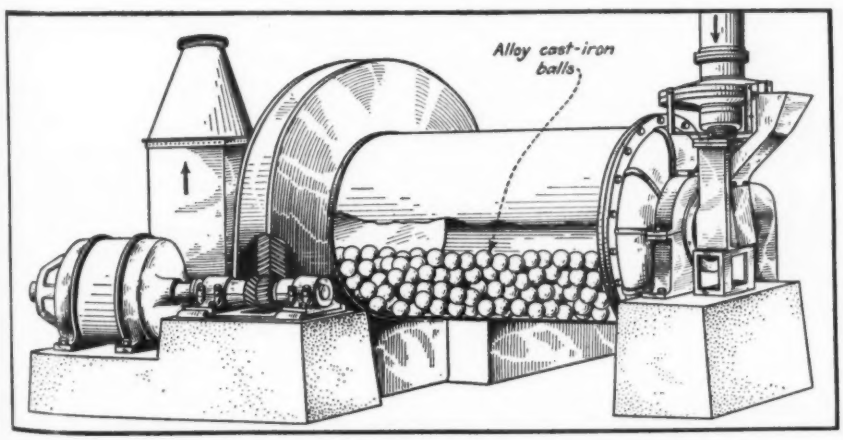
A full-scale production test for a period of at least one year was decided upon as the most satisfactory procedure. Accordingly, an 8-ft-diameter 17-ft-long ball mill was selected for the test. This air-swept mill grinds the No. 4 and finer buckwheat feed to 77% through 200 mesh and 95% through 100 mesh. It carries a 27-ton ball load and is driven at 27 rpm by a 500-hp motor.

The test was started by emptying and cleaning the mill and charging 27 tons of alloy cast-iron balls, 25% of them two inches in diameter and 75% one and one quarter inches. They were supplied by the Pennybacker Co of Emaus, Pa. Only alloy balls were used for makeup and an accurate record was kept of weight added and coal tonnage pulverized each week. Except for a slight reduction in mill output during initial wearing-in pulverization rate was normal at 12½ tons per hour.

At the end of the 55-week test, the mill was emptied and the weight of balls remaining in the charge determined. The record showed that during this time 106,785 net tons of dry coal had been pulverized with a ball consumption of 33,114 lb, giving a wear factor of 0.31 lb per ton of coal. The comparable wear loss for forged steel balls in the same mill during the preceding six years had averaged 0.67 (See table.). Despite the alloy balls' higher initial cost (25 to 75% higher) the 54% reduction in ball consumption will enable the Pennsylvania Power & Light Co to effect an annual saving of approximately $10,000 in grinding cost at the two stations using pulverized coal.

Wartime restrictions prevented continued use of alloy balls, but this situation has now changed so that the economies effected by this improved grinding medium are again being enjoyed, and later on will be extended to the company's other plants.

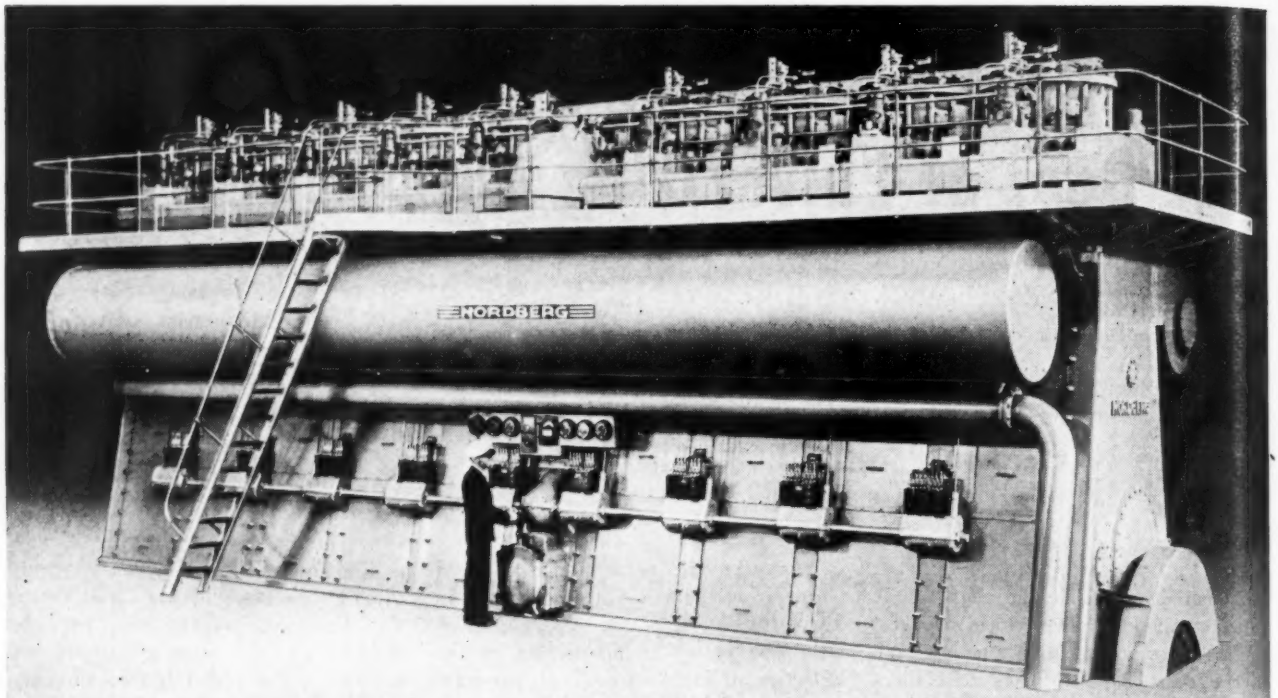
* Reg. U. S. Patent Office



This 8-ft-diameter 17-ft-long air-swept ball mill grinds No. 4 buckwheat and finer to 77% through 200 mesh and 95% through 100 mesh. It carries a 27-ton ball load

Comparative Wear Loss of Grinding Balls

Kind of ball:	Steel	Alloy CI
Length of test:	1-6-35 to 6-2-41	6-5-41 to 6-30-42
Coal pulverized, net tons	627,465	106,785
Ball consumption, lb	419,603	33,114
Constant for ball wear, lb per net ton	0.67	0.31



Tests Reveal Performance of America's Most Powerful Single-Acting Diesel

Built for Victory ship drive, 6000-shp 2-cycle mechanical-injection blower-scavenged engine shows good fuel economy in 17-day continuous test on heavy low-grade fuel oil

▶ EXHAUSTIVE SHOP TESTS of the most powerful single-acting diesel engine yet built in this country indicate ability to operate sucessfully, with good fuel economy, on heavy low-grade fuels. As announced in the news columns of June POWER, this 6000-shp 2-cycle mechanical-injection 9-cylinder 29x40-in. engine was developed by the Nordberg Mfg Co for direct-drive marine use and will be installed in one of the Maritime Commission's Victory ships. Units of similar design, in sizes from 4000 shp (6 cylinders) to 8000 shp (12 cylinders) will be available for ship propulsion in single- or twin-engine direct-drive and twin-engine geared single-screw combinations, as well as for stationary applications ranging from 3000 to 6000 kw. This article outlines construction features of the engine built for the Maritime Commission and gives test results.

For marine application, the unit operates at 160 rpm and the 6000-hp normal rating is obtained at 62-psi brake mean effective pressure. An overload of 10% can be carried continuously and 25% for two hours. The standard speed of 160 rpm is low enough for direct drive with suitable propeller efficiency in single- or twin-screw ships, but the engine may also drive through reduction gears with optimum propeller efficiency. Engine design permits operation through the entire speed range without harmful peaks of torsional vibration. For stationary service the standard speed is 164 rpm, at which the rating is 500 kw per cylinder.

Engine Design

In general design this record-breaking engine follows the lines of recent Nordberg 2-cycle diesels, exceptions being the camshaft drive, the reversing mechanism and the overhead location of the camshaft, necessitated by the increased physical dimensions. Sectional view on the facing page reveals the simplification and reduction in number of parts achieved and the rugged construction of such parts as bedplate, "A" frames and cylinders.

The bedplate is cast in two sections, which are bolted together. The crankshaft consists of two one-piece forgings, one with five cranks and the other with four. Crankpins and journals are 20 in. diameter and the complete shaft, finished all over, is 42 ft, 2 in. long and weighs approximately 80,750 lb. Main and crankpin bearings have removable steel-backed shells lined with centrifugally cast anti-friction metal. Crosshead bearings are one-piece copper-base-alloy bushings.

Frame structure consists of a series of cast-iron "A" frames, which rest on the bedplate and support the cylinder blocks containing the liners. The "A" frames are cored for tie rods, which are anchored below and on each side of each main-bearing housing in the bedplate and extend through each leg of the "A" frame and the cylinder blocks to form a rigid assembly. The tie rods are tightened by means of a special hydraulic jack to insure equal stress on all tie rods and members.

A separate casting forms each cylinder block, fitted and bolted to the blocks adjacent to it. Liners carry the patented system of scavenging and exhaust porting found on all Nordberg diesels of the 2-cycle type. On each

cylinder, an individual lubricator introduces lubricating oil at seven points on the periphery and near the upper end of the liner. A layshaft located at a convenient height above floor level and timed to deliver oil to each piston at a predetermined point in its stroke drives the lubricators.

At the bottom of each liner a casting containing two pairs of internal expanding wiper rings fits the piston skirt and returns excess oil to the crankcase, while carbon particles and other foreign matter drain into a recess in the casting and thence to a header leading to the sludge tank, obviating contamination of lube oil in the system.

Located on one side of the engine, the scavenging header carries floor plate to form a platform. Automatic plate valves in the header and adjacent to the scavenging ports of each cylinder prevent exhaust-gas backflow. Two motor-driven scavenging blowers, supplied from auxiliary generating sets, furnish scavenging air.

This engine was built with crossheads but the general design permits either this or trunk-piston construction. Crosshead guides bolt to the "A" frames. Both trunk and crosshead pistons consist of head and skirt. Circulation of a large quantity of oil at high velocity through cast labyrinth passages cools the head. Crosshead piston skirts rest on a flange of the crosshead, centered and fastened by cap bolts.

The pressure lubrication system delivers oil to all working parts through a large header in the crankcase with leads to all bearings, camshaft drive and reversing gears. Drilled passages in both webs of each crank and in the connecting rod conduct lube oil to crankpins, crosshead pins and to the oil-cooled piston head. Oil from bearings, gears and piston heads returns to the sump from which it is delivered by a motor-driven pump through a shell-and-tube oil cooler and filter.

Control System

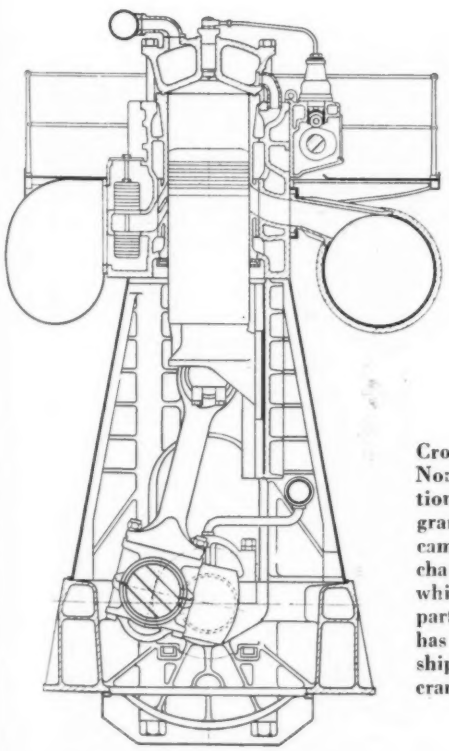
A single lever on the port side of the engine controls starting, fuel regulation, reversing and stopping through a simple mechano-pneumatic system with dependable interlocks to prevent improper manipulation.

The gear train driving the camshaft incorporates an ingenious reversing mechanism adapted from that long used on Nordberg reversing steam engines for mine hoists. The driving gear mounts on the integrally flanged coupling halves where the crankshaft bolts together between fourth and fifth cranks. As shown in the diagrams below, movement of a planetary gear in the train controls the angular relationship between the camshaft with its fuel cams and the crankshaft. For stationary applications, fixed-center gears are used.

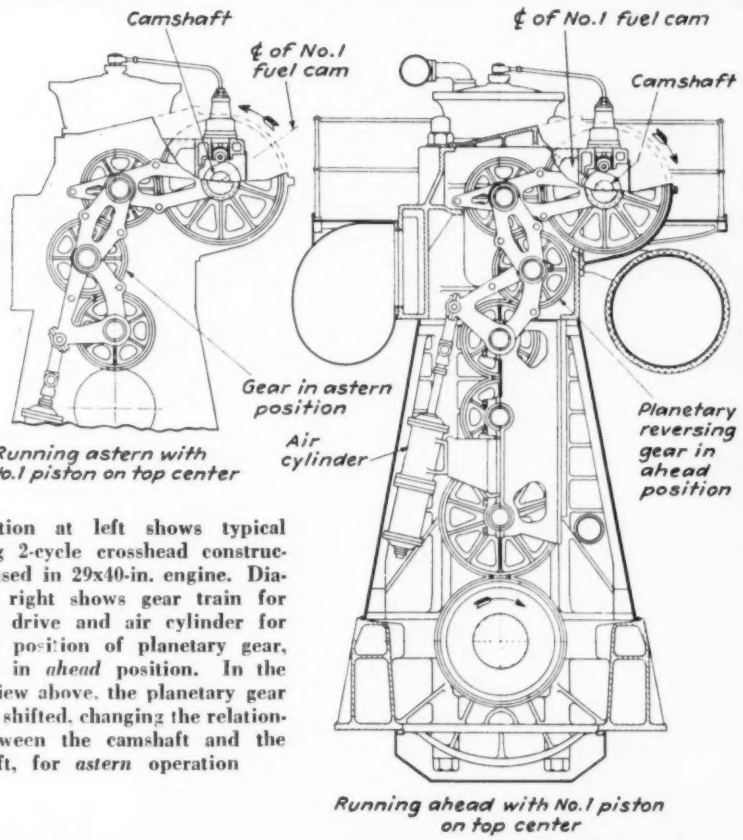
Largest of their type ever made in this country, the fuel pumps were developed by American Bosch in collaboration with Nordberg engineers. The engine design permits application of the Nordberg system of gas injection so that natural or manufactured gas may be burned with diesel efficiency.

After complete erection in the shop, the following tests were run: (1) 360-hr continuous endurance run at normal 6000 shp and 160 rpm (2) 48-hr continuous run at 6450 shp (110% load) and 165 rpm (3) 2-hr at 7300 shp (125%) and 172 rpm. Other tests determined starting, governing and maneuvering characteristics and fuel consumption at various loads with corresponding propeller rpm. The engine burned heavy fuel oil in all tests. Curves show test performance, not including power for scavenging blowers.

High-power diesels for ship propul-



ENGINE CROSS-SECTION


Camshaft
℄ of No.1 fuel cam
℄ of No.1 fuel cam
Camshaft
Gear in astern position
Air cylinder
Planetary reversing gear in ahead position
Running astern with No.1 piston on top center
Running ahead with No.1 piston on top center

REVERSING MECHANISM

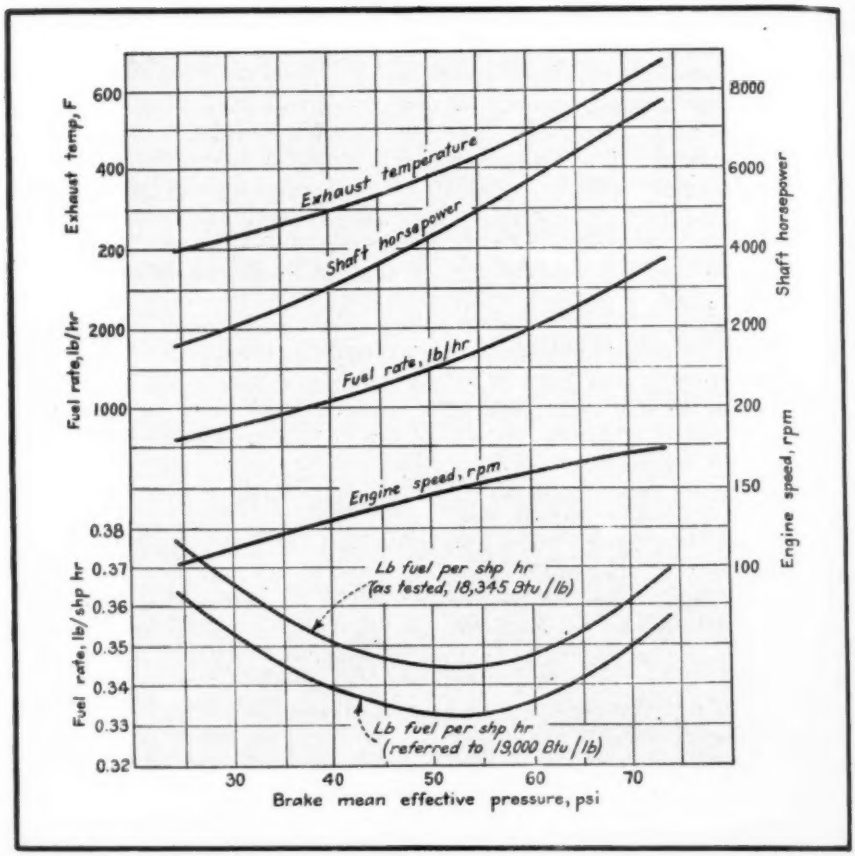
Cross-section at left shows typical Nordberg 2-cycle crosshead construction as used in 29x40-in. engine. Diagram at right shows gear train for camshaft drive and air cylinder for changing position of planetary gear, which is in *ahead* position. In the partial view above, the planetary gear has been shifted, changing the relationship between the camshaft and the crankshaft, for *astern* operation

sion must be capable of operation on low-grade fuel oils. In this mechanical-injection engine with watercooled fuel nozzles, fuel consumed during the continuous 17-day test at 100, 110 and 125% loads varied from 1000 to 1200 SSU at 100 F, and 11.5 to 12.5 deg Baume at 60 F. It contained from 11.4 to 17% hard asphalt and 9 to 10% Conradson carbon. Prior to the official tests, heavier fuel oils of 1400 to 1600 SSU were burned for long periods with clear exhaust and no trouble.

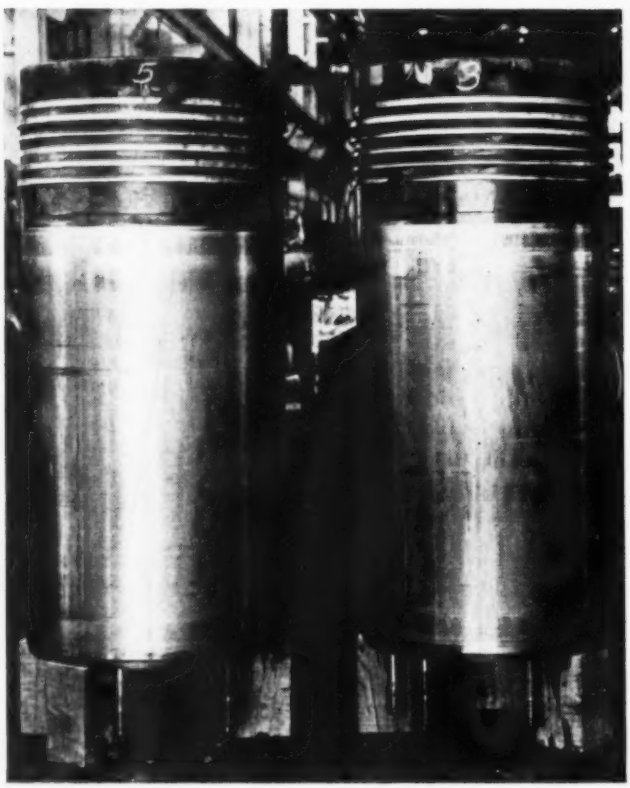
Many samples of the fuel used during official tests showed the following average analysis after centrifuging:

SSU, 100 F	1076
Baume gravity, 60 F	11.5
Flashpoint, F	261
Firepoint, F	324
Sulphur, %	0.82
Water and sediment, %	0.59
Hard asphalt, %	13.2
Conradson carbon, %	9.57
Heating value, Btu/lb	18,345

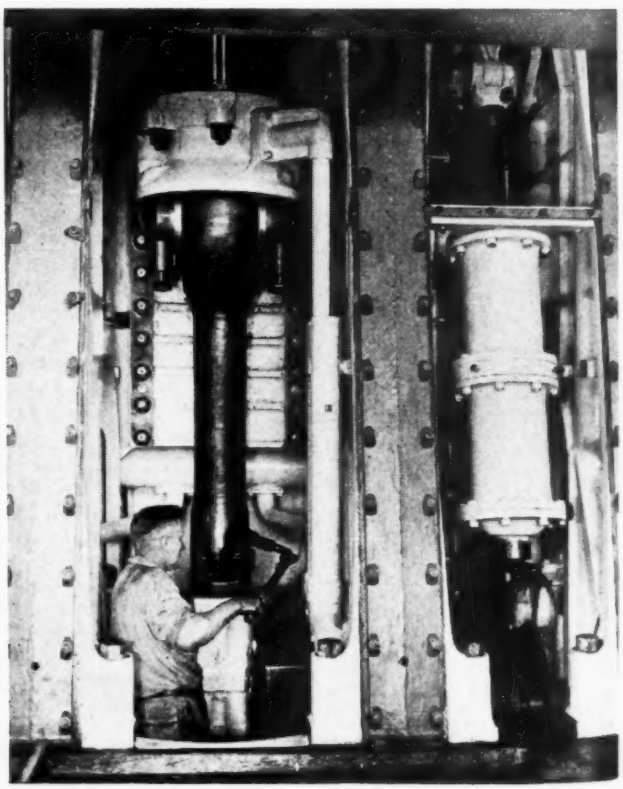
For successful burning of low-grade fuels, proper timing of fuel admission is essential. On this engine, timing may be varied easily within the limits for a wide range of fuels. Official post-test examination revealed unusual cleanliness of injection nozzles and pistons (See piston photo below.).



Test results of 6000-shp engine: These do not include power to drive scavenging blower (430 hp at normal load). Blower power will be supplied by auxiliary sets

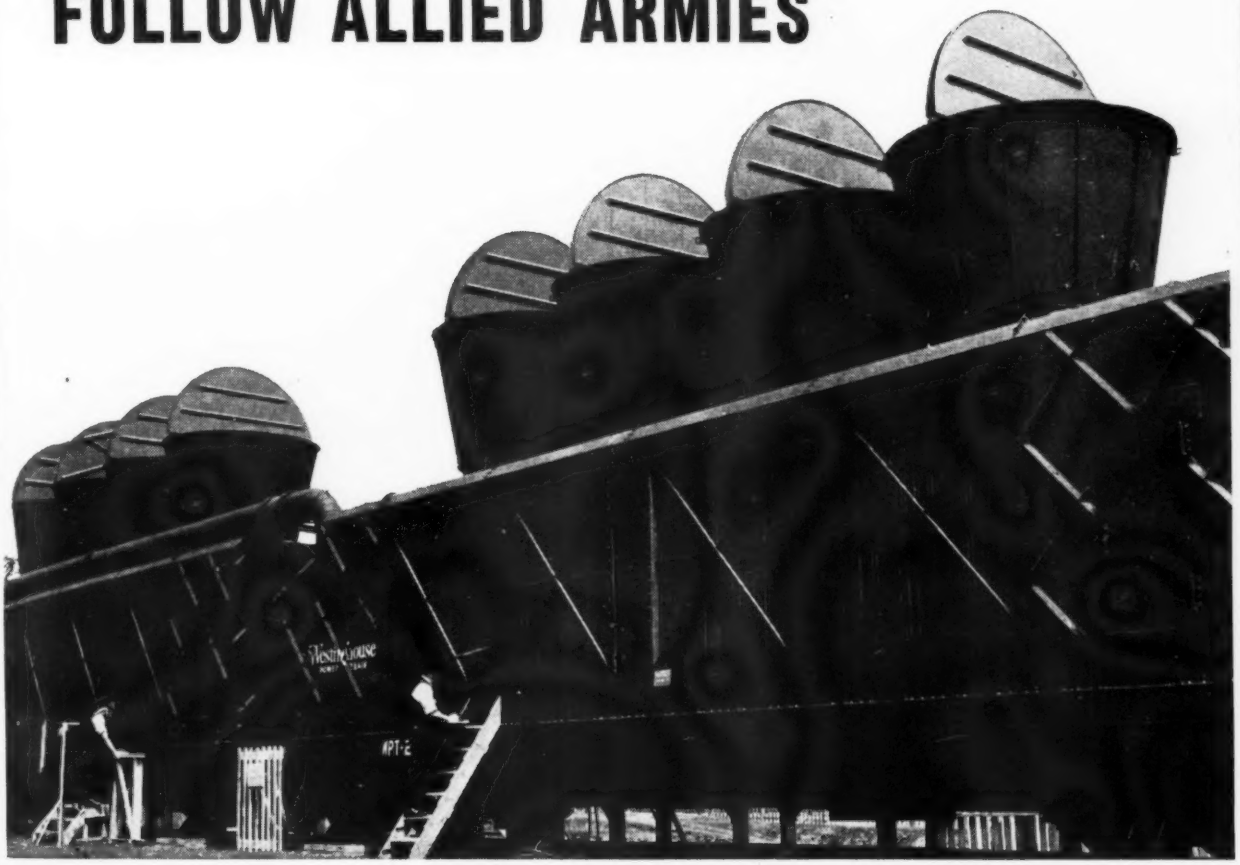


Condition of typical pistons after 17-day continuous test: 360 hr at 6000 shp, 48 hr at 6450 shp and 2 hr at 7300 shp



With cover plates removed, crankshaft, connecting rods, crossheads, pistons and reversing mechanism are readily accessible

5000-KW POWER TRAINS FOLLOW ALLIED ARMIES



Occupation forces require power for base hospitals, machine shops, repair shops and replacement parts manufacturing. C M Laffoon of Westinghouse details component parts and problems of design for largest mobile power trains*

▶ IN COUNTRIES where power plants have been destroyed or put out of commission, a certain amount of power is required over and above that used primarily for military operations. In addition to shops and hospitals, civilian population requires reestablishing water supply and sewage systems and other incidentals of rehabilitation to become self sustaining and cooperate with the military program.

Present power needs of devastated areas are taken care of by small steam and diesel units that are readily transported and quickly installed in vital areas. Some authorities suggest that the amount of mobile power should be on the order of 2 to 3% of the generating capacity available prior to demolition. As the war progresses, need for mobile generating plants is expected to increase in central Europe as well as Asia.

Now building are ten 5000-kw portable self-contained steam-electric power plants (plus 24 smaller units of 1000 kw) assembled on specially designed railway cars that require only satisfactory track sidings and certain supplementary foundation supports to start generating electric power within hours of arrival at a given location. When a power train is on a railway siding, water, steam and electrical interconnections must be made between cars, and some reassembly of parts removed because of weight and clearance limitations is necessary. Since most railway sidings are neither straight nor level, concrete piers or block supports may be employed at each car end, the car frames being raised to the proper height by hand-operated hydraulic jacks.

A primary objective in mobile-plant design is that of obtaining maximum output per unit of materials; performance efficiency and super-reliability obtained by duplication of auxiliaries must take secondary position. Requirement that the entire plant be transported over rails in practically complete assembly necessitates arranging cars in tandem, limiting height and width, prescribing weight per axle and total car weight. Further requirements of foreign operation involve (1) burning low-grade lignite of 7300 Btu per lb, 22% ash and 24% moisture (2) getting up steam without external power supply (3)

* Condensed from a paper presented at the ASME semiannual meeting in Pittsburgh, June 21, 1944

using minimum water for makeup and cooling (4) obtaining full rated output over an ambient temperature range of −40 to +95 F with air-cooled condensers.

Equipment has to be designed and supported to withstand shocks of moving at freight train speed over rough road beds and to take sudden starts and stops; cars must also be strong enough to take the twisting forces of derailment and other contingencies. Special supports incorporated to meet these conditions must, in most instances, be removed before the power train can be operated as a generating plant.

Mechanical and thermal problems are essentially similar to those of a conventional power plant of the same rating and steam conditions. Expansion problems, however, due to the wide range of ambient temperature and the great length of the power train unit require careful consideration.

Eight railway cars, approximately 50 ft long, house and support main and auxiliary equipment. Cars have double walls for all exposed surfaces with thermal insulation in the interwall space. They were designed and built by General American Transportation Corp at East Chicago.

Air-Cooled Condensers

Main steam condensers are of novel design to use air as the cooling medium; no water can be used for this purpose. Prime requirement is recovery of 80,000 lb per hr of condensate from the turbine exhaust steam at a back pressure of about 2-psi gage. Steam must reach all cooling surfaces so that ice does not form in idle areas at low ambient temperatures leading to blocked and ruptured tubes. Flow of air through individual condenser sections can be controlled by use of 3-piece covers for the air intakes. Sections are added or removed depending on outside temperature conditions.

Eight condensing sections are installed on each of two cars. Four blowers on each car draw air through the condenser to a plenum chamber and discharge upward through short stacks with hinged covers that prevent recirculation when individual blowers are shut down because of low air temperature. A single-stage ejector with air-cooled aftercondenser draws air from steam spaces to prevent cold spots and possible ice formation.

Each individual condenser section has ten rows of tubes in five groups of two each. This arrangement is adapted from surface-condenser practice to compensate for varying condensing capacity as air temperature rises through the condenser. If all tubes were connected in parallel, cold tubes would not get enough steam while warmer ones would pass steam out through the vent. By dividing tubes into groups and putting an orifice in series with each group, controlling pressure drop is at the orifice rather than across the tubes. Any excess steam passing through orifices of the first four groups is condensed in the fifth group which serves as "air cooler." Usual practice of putting air cooler at condenser's coldest part is reversed here to prevent freezing. Condensate dropping from tubes is reheated and deaerated by incoming steam.

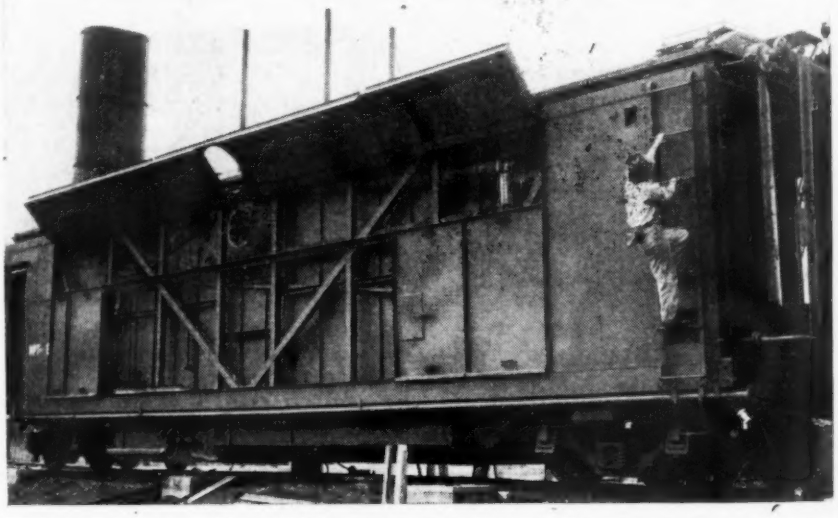
Air-temperature rise through the condenser at full load is 90 F when condensing 80,000 lb per hr of steam with 800,000 cfm of air circulating. A fin-tube area of 90,000 sq ft is carried by 10,500 sq ft of galvanized-steel tubing.

In addition to the main unit, the turbine-generator car contains a 93.8-kva 75-kw 380/220-v 4-wire 50-cycle diesel-engine generator set, a 750-kva 380/220-v 3-phase 4-wire 50-cycle air-cooled transformer and switchgear. Main 5000-kw turbine takes steam at 600 psi 750 F and exhausts at 2-psi gage. The generator delivers power at 6300/10,900 v, 50 cycles, 0.8 pf at 3000 rpm and is equipped with air filters to aid in maintaining machine cleanliness.

The auxiliary-power transformer is connected to the main generator through fuses and has a low-voltage breaker assembly mounted within the transformer housing. Totally inclosed metal-clad switchgear contains oil circuit breakers for main-generator control, four high-voltage feeder circuits and fuses for auxiliary-power transformer. Breakers are electrically operated, mechanically trip free, rated at 600 amp, 15,000-v with 150,000 kva interrupting capacity.

Auxiliary car contains two 3600-rpm boiler-feed pumps driven by Westinghouse turbines taking steam from the main header and exhausting to the main condenser. An evaporator of 2100-lb-per-hr capacity with deaerator and supply pump is provided. One of three 400-cfm air compressors is driven by a direct-connected 100-hp 50-cycle 720-rpm induction motor, the other two by geared turbines. Compressed air is used for stoker drive, coal spreaders and soot blowers. An air-storage tank, water-cooling tower and pump complete the equipment.

A separate car with thermally insulated tank and provided with heating coils has a feedwater storage capacity of 10,000 gal of treated water.

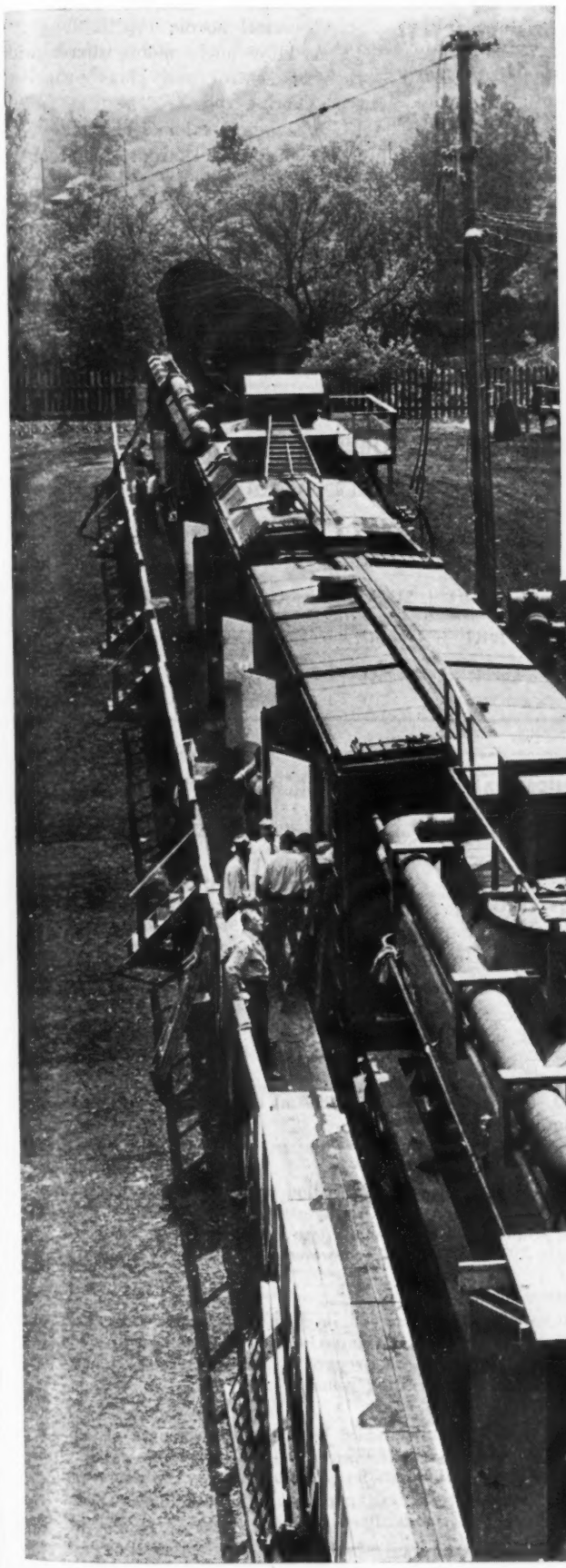


Each boiler car supplies 40,000 lb per hr of 660-psi 750-F steam. Locomotive type stoker can burn low-grade coals and soot blowers use compressed air to save water

Boiler-car units are essentially duplicates but with stoker ends adjacent to each other. Each 40,000-lb-per-hr 2-drum bent-tube waterwall boiler, designed for 660 psi 750 F with feedwater entering at 200 F, has superheater and economizer, soot blowers and locomotive-type stoker. Two 9900-cfm motor-driven forced-draft fans and one 2-speed 46,000-cfm motor-driven induced-draft fan handle combustion air. Necessary measuring instruments and control equipment are provided. Boilers were designed and built by Combustion Engineering Co, which also assembled steam-generating units on the cars.

A separate service car provides living quarters for the operating crew of about a dozen and space for light repair work.

Feedwater storage tank car is partly hidden by boiler-car stack, then follow auxiliaries, turbine-generator car next, and finally two condenser cars with hinged covers open. A second boiler car and crew-maintenance unit complete train



Individual condenser inlet openings can be closed off by three-section panels when low outdoor temperatures are met

Precision Testing for Dissolved

In this concluding installment of a series on oxygen test methods, J F Sebald, Worthington Pump and Machinery Corp, describes in detail chemical reactions, reagents, equipment and procedure for one modification of the Winkler test

▶ To afford a specific illustration of test procedure that will, if followed implicitly, yield a maximum degree of accuracy, the Schwartz Gurney "A" modification of the Winkler test is here described in considerable detail. While this test is not necessarily suited to all variations in water conditions, it is sufficiently accurate and reliable for determining dissolved oxygen content of well deaerated boiler feedwater and is the simplest of the several refined variations of the Winkler test.

Chemical reactions involve liberation of free iodine in a sample in exact proportion to the quantity of dissolved oxygen present. Quantitative analysis of the sample for free iodine is a means of determining the amount of dissolved oxygen originally present. Reactions are indicated in Table IV and reagents in Table V. The following equipment is required:

1. Cooling coil with double sample outlet connection and of sufficient surface to cool two liters per minute at least 10 F below room temperature
2. Two one-foot lengths of ¼-in. inside diameter gum-rubber hose. New hose should be boiled in dilute caustic soda for 30 min to remove traces of soluble sulphur
3. Two 500-cc McLean gas-sampling flasks with standard ground-glass stopcocks at each end and 8-mm-bore tube extensions 2-in. long. Tube extensions are etched with two marks to measure exactly one cc; the mark nearest stopcock is about 10 mm away from it
4. Three reagent storage burettes not graduated, large enough to hold 50 cc each
5. Stand for supporting reagent burettes
6. Pinchcock for use on one sampling hose
7. A 5-mm-outside-diameter copper tube about 4 in. long for washing flask ends between additions of reagents
8. A 10-cc glass graduate for measuring sample drain-off
9. An 800-cc titrating beaker
10. Five 1-cc pipettes graduated in 0.01-cc divisions
11. A tuberculin hypodermic syringe fitted with a 0.2-cc measuring pipette graduated in 0.01-cc divisions with a stainless-steel needle 1½ in. long
12. A 110-v ac-dc motor stirrer with rheostat control and glass propeller-type stirring rod
13. A standard calomel electrode
14. A platinum electrode, 1 cm square
15. Set of insulated copper lead wires
16. A 120-F laboratory thermometer
17. A 40-cc starch solution container with 1-cc bulb pipette
18. Electric potentiometer suitable for measuring to one millivolt with range to include measurements from 100 to 500 millivolts

TABLE IV—CHEMICAL REACTIONS OF THE WINKLER TEST

(1) $MnSO_4 + 2KOH \rightarrow Mn(OH)_2 + K_2SO_4$

(2) $2Mn(OH)_2 + O_2 \rightarrow 2MnO(OH)_2$

(3) $MnO(OH)_2 + 2KI + H_2O \rightarrow Mn(OH)_2 + I_2 + 2KOH$

(4) $I_2 + Mn(OH)_2 + 2KOH + 2H_2SO_4 \rightarrow K_2SO_4 + 4H_2O + I_2 + MnSO_4$

(5) $KH(IO_3)_2 + 10KI + 11H_2SO_4 \rightarrow 6I_2 + 11KHSO_4 + 6H_2O$

(6) $I_2 + 2Na_2S_2O_3 \rightarrow Na_2S_4O_6 + 2NaI$

TABLE V—CHEMICAL REAGENTS FOR THE WINKLER TEST

No. 1—Manganous sulphate (any of the following in distilled water to make one liter of solution)

362 grams $MnSO_4 \cdot H_2O$
400 grams $MnSO_4 \cdot 2H_2O$
439 grams $MnSO_4 \cdot 3H_2O$
478 grams $MnSO_4 \cdot 4H_2O$
515 grams $MnSO_4 \cdot 5H_2O$
554 grams $MnSO_4 \cdot 6H_2O$
593 grams $MnSO_4 \cdot 7H_2O$

No. 2—Alkaline potassium iodide

700 grams cp KOH plus 150 grams cp KI dissolved in separate portions of distilled water, mixed, and diluted to one liter

No. 3—Sulphuric acid

750 ml of cp H_2SO_4 (sp gr 1.84) added to 250 ml of distilled water to make one liter of solution

No. 4—Potassium bi-iodate

6.498 grams cp $KH(IO_3)_2$ dissolved in distilled water to make exactly one liter of solution. This solution is relatively stable and retains its strength for a long time if properly stored. To prepare N/200 solution, exactly 5 cc is diluted to exactly 200 cc with distilled water

No. 5—Sodium thiosulphate

49.64 grams of cp $Na_2S_2O_3.5H_2O$ dissolved in distilled water to make exactly one liter of solution. This solution is relatively stable and retains its strength for one month if properly stored. To prepare N/200 solution, exactly 5cc is diluted to exactly 200 cc with distilled water

Note: The bi-iodate solution is the standard by which the strength of sodium thiosulphate titrating solution is determined. Weak solutions of sodium thiosulphate are relatively unstable; also, in continued use, potassium bi-iodate and sodium thiosulphate solutions are exposed to contamination; dilute solutions should be made and standardized at the beginning of each series

Oxygen in Boiler Feedwater—III

19. Watch with sweep second hand
20. A 250-cc glass graduate
21. A 130-cc square low-form ground-glass-stoppered bottle for manganous sulphate solution
22. Similar 130-cc bottles for alkaline potassium iodide (Pyrex), sulphuric acid solution, 1/10 normal sodium thiosulphate, 1/200 normal sodium thiosulphate, 1/200 normal potassium biiodate, and chromic acid cleaning solution
23. Tube of stopcock grease and data sheets.

In collecting samples, the technique employed is of fundamental importance. The sample takeoff connection should preferably be located in the effluent line from the deaerating equipment as close to the water storage compartment as possible.

A counter-current sample cooler can be made by inserting 18 ft of ⅜-in. OD soft copper tubing inside a 14-ft length of ¾-in. OD tube and forming a compressed helical coil of about 6-in. diameter. Coils end in a suitable header for sample and cooling-water connections.

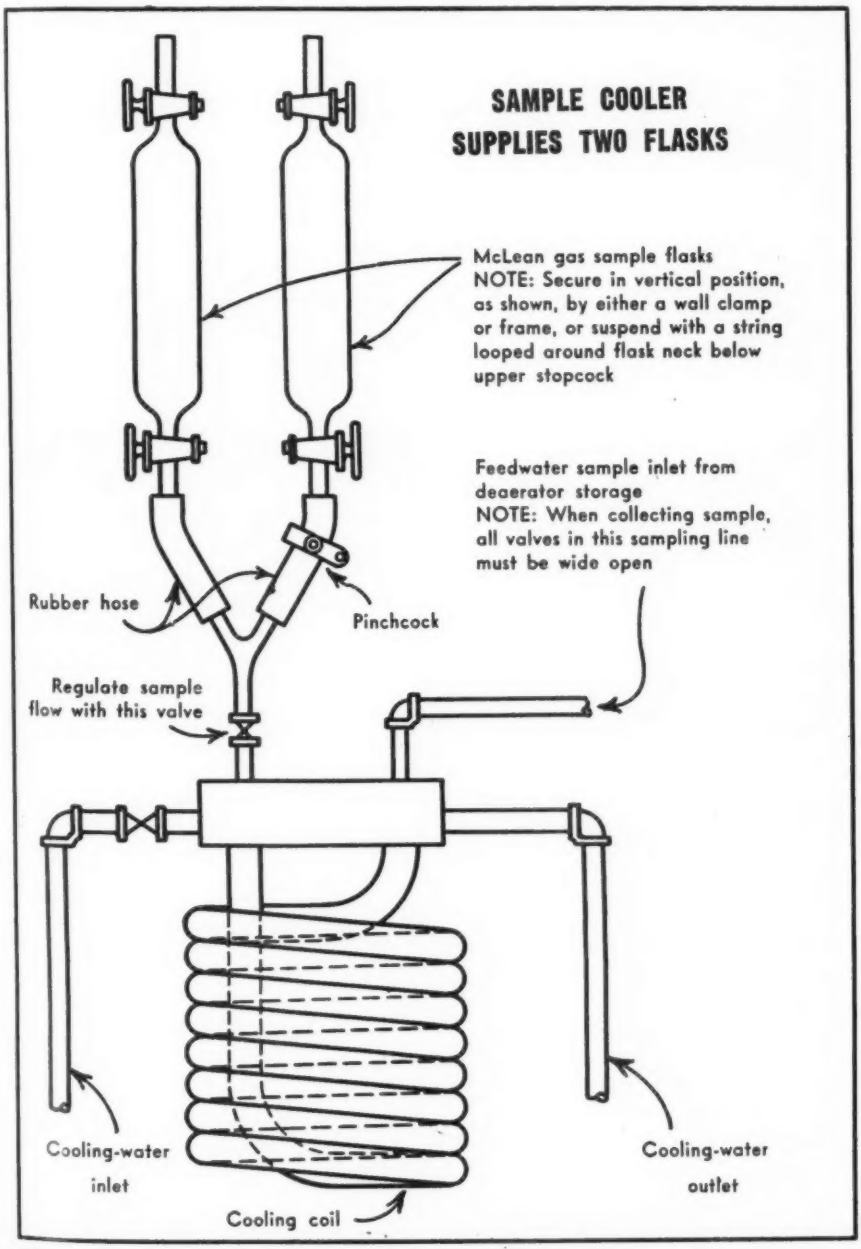

SAMPLE COOLER
SUPPLIES TWO FLASKS
McLean gas sample flasks
NOTE: Secure in vertical position, as shown, by either a wall clamp or frame, or suspend with a string looped around flask neck below upper stopcock
Feedwater sample inlet from deaerator storage
NOTE: When collecting sample, all valves in this sampling line must be wide open
Rubber hose
Pinchcock
Regulate sample flow with this valve
Cooling-water inlet
Cooling coil
Cooling-water outlet

Fig. 11—Counter-current sample cooler formed by inserting 18 ft of ⅜-in. soft copper tubing inside 14 ft of ¾-in. and bending to a coil about 6-in. diameter

During sampling, any shutoff valves in the line between cooler and sampling connection should be fully open. Cooling water quantity should be sufficient to bring sample temperature at least 10 F below room temperature. Short lengths of rubber tubing securely wired to the discharge end of the cooling coil serve as connections to the McLean flasks.

Deaerated water should flow through the cooling coil for at least a half hour to expel air from the sampling line and flush it clean of foreign particles and loose scale. McLean flasks should be thoroughly cleaned before being connected to the rubber tubes of the cooling coil. Flow through the flasks should be adjusted by the valve between cooling-coil discharge and the flasks so that a complete change in volume of the sampling flasks occurs in about one minute. Flasks should be held vertically with upper and lower stopcocks open.

Clear All Bubbles

At least ten volume changes should occur in the flasks after all visible air bubbles have been expelled. Occasional oscillation of the flasks about their longitudinal axes while water is flowing helps free any small air bubbles adhering to the inside surfaces. Each stopcock should be rotated 180 deg at least once during sample collection to free adhering bubbles.

Bubbles do not adhere readily to thoroughly cleaned surfaces of the flasks but they do cling to greased surfaces of stopcocks. One visible bubble in the Winkler sample introduces sufficient error to render the sample worthless.

After all air has been purged from the sampling flasks and ten or more volumes have passed through, the stopcocks should be quickly closed and rubber tubing connections removed from the McLean flasks. If sampling line pressure is high, the valve between sample cooler and flasks should be shut before closing the stopcocks. Samples are now ready for "fixing," that is, introducing the chemical reagents.

Washing flask ends with a jet of deaerated water is facilitated by inserting a 5-mm by 4-in. long copper tube in one of the rubber hose connections to the sample cooler and closing off the other hose by a pinchcock, as illustrated in Fig. 11. Flow is adjusted to produce

a forceful stream of water by throttling the valve in the sampling line.

The Winkler sample should be fixed immediately. With stopcocks closed the flask is oscillated briskly about its transverse axis to shake water out of the flask ends. Holding the flask in a vertical position, the operator introduces No. 1 reagent from its storage burette into the flask end until the level reaches the upper etched mark. Opening the upper stopcock allows pressures to equalize, after which opening the lower stopcock carefully allows reagent to enter the flask. When the reagent reaches the lower etched mark, the lower stopcock is closed first, then the upper one and both ends of the flask are washed thoroughly with the jet of deaerated water.

No. 2 reagent is introduced through the opposite end of the flask by exactly the same procedure, including washing both flask ends. No. 3 reagent is added through the same end of the flask as No. 1.

The interference sample is fixed with the same reagents and the same procedure as the Winkler sample including removal of water from the flask ends and washing between addition of reagents. However, No. 2 reagent is added first in the interference sample, followed by No. 3 reagent from the opposite end of the flask, and then by No. 1 reagent through the same end of the flask used for No. 3. Procedure for both samples is outlined diagrammatically in Fig. 12.

The Winkler sample should be titrated first. With the flask in a vertical position, 10 cc of sample is drained into the 10-cc graduate from the flask end used for introducing the No. 2 reagent. This operation removes the unfixed reagents trapped in the stopcock bore.

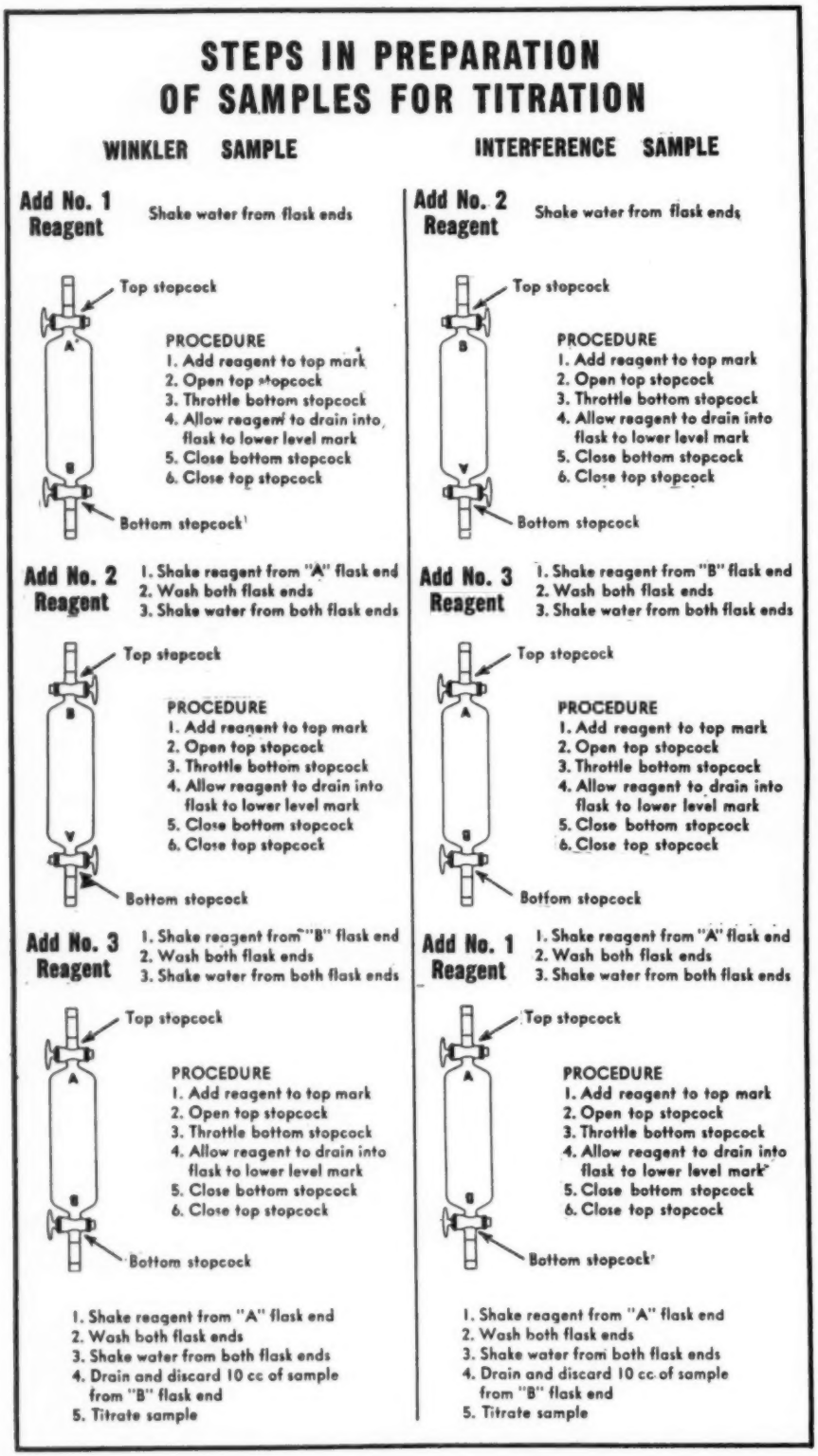

STEPS IN PREPARATION OF SAMPLES FOR TITRATION
WINKLER SAMPLE
INTERFERENCE SAMPLE
Add No. 1 Reagent
Shake water from flask ends
Top stopcock
PROCEDURE
1. Add reagent to top mark
2. Open top stopcock
3. Throttle bottom stopcock
4. Allow reagent to drain into flask to lower level mark
5. Close bottom stopcock
6. Close top stopcock
Bottom stopcock
Add No. 2 Reagent
1. Shake reagent from "A" flask end
2. Wash both flask ends
3. Shake water from both flask ends
Add No. 3 Reagent
1. Shake reagent from "B" flask end
2. Wash both flask ends
3. Shake water from both flask ends
1. Shake reagent from "A" flask end
2. Wash both flask ends
3. Shake water from both flask ends
4. Drain and discard 10 cc of sample from "B" flask end
5. Titrate sample
Add No. 2 Reagent
Add No. 3 Reagent
Add No. 1 Reagent

Fig. 12—Steps in preparation of Winkler and interference samples for titration including detailed procedure for adding reagents and preventing contamination

Titration Procedure

Contents of the flask are then emptied into the 800-cc titrating beaker. Electrodes and stirrer are then immersed in the sample with the stirrer adjusted to give maximum agitation without producing a vortex.

After adding approximately 1 cc of fresh starch solution, the operator introduces exactly ½ cc of N/200 potassium bi-iodate to the sample and allows about one minute for the completion of the reaction before recording the difference of potential across the electrodes as read on the electric potentiometer. Sodium thiosulphate, N/200, is added from the 1-cc micro burette until the blue color of the starch indicator just disappears. Again allowing about a minute for completing the reaction, the operator records electrode potential difference.

For completing the titration, the graduated tuberculin syringe is first rinsed with N/200 sodium thiosulphate, then completely filled and drained down to the zero graduation. After each 0.01-cc increment of sodium thiosulphate is added about 30 sec should elapse before the electrode potential is read and recorded. When the change in millivolts per 0.01 cc of thiosulphate becomes maximum the end point is

reached. However, several more increments of thiosulphate should be added after the end point and readings recorded to establish definitely the validity of the end point.

The same procedure is followed in preparing and titrating the interference sample, including draining 10 cc through the flask end used for introducing the No. 2 reagent. A typical log sheet showing data from one Winkler and one interference sample is illustrated in Fig. 13.

Reagent Correction

Reagent solutions contain some dissolved oxygen which causes the uncorrected Winkler sample to give results that are too high. It is generally considered that the amount (cc) of dissolved oxygen present in one cc of each of the reagents is approximately:

No. 1. (manganous sulphate)	0.00167*
No. 2. (alkaline potassium iodate)	0.00009
No. 3. (sulphuric acid)	0.00004

*Assumed same as for manganous chloride

When adding 1 cc each of the three reagent solutions to a 500-cc sample, a negative correction of 0.0036 cc of oxygen per liter of water is recommended to account for oxygen introduced with the reagents.

This correction does not apply to the interference sample. The order of adding reagents prevents dissolved oxygen from entering into the reaction.

To correct for flask volume other than 500 cc, the negative 0.0036 cc per liter should be multiplied by 500 and divided by the total flask volume in cc.

In computing results, the amount of dissolved oxygen in the sample is calculated from the titration results in four steps as follows:

1. Calculation of total dissolved oxygen equivalent in the *Winkler* sample, cc per liter

$$O_2 = \frac{N \times T \times 139.95}{V \times 0.025}$$

where

N is normality of sodium thiosulphate solution expressed as a decimal, that is $N/200 = 0.005$

T is cc of sodium thiosulphate solution

V is volume of flask minus 10 cc. Flasks must be matched so that they are of equal volume

2. Calculation of total dissolved oxygen equivalent in the *interference* sample, cc per liter

$$O_2 = \frac{N \times T \times 139.95}{V \times 0.025}$$

3. Calculation of *gross* amount of oxygen in the Winkler sample, cc per liter, which is dissolved oxygen equivalent in Winkler sample, minus that in interference sample

4. Calculation of *net* dissolved oxygen in water being sampled, cc per liter, which is gross amount of oxygen in the Winkler sample minus oxygen added with reagents.

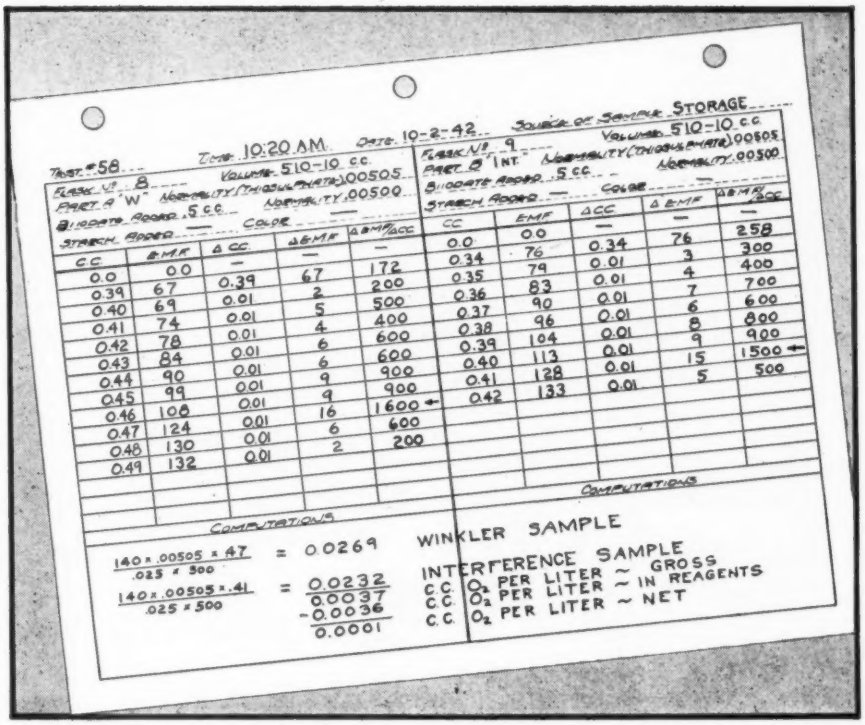


Fig. 13—Typical log sheet for titration of one Winkler and one interference sample including computations necessary for obtaining dissolved oxygen value

Impurities in the water to be tested cause the direct titration of the Winkler sample to be relatively inconclusive when determining low concentrations of dissolved oxygen. Some impurities are oxidizing; that is, they have the same effect as dissolved oxygen on the Winkler reagents. The total oxidizing effect of all such impurities is called *positive* interference. The interference sample measures the effect of such oxidizing compounds without including the dissolved oxygen present in the sample and is used to correct for interference present in the Winkler sample.

Some impurities in water are reducing; that is, they have the opposite effect of dissolved oxygen on the Winkler reagents. The total reducing effect of all such impurities is caller *negative* interference. The interference sample measures the effect of such reducing compounds. It is recognized that the correction for interference thus obtained may not be exact for either positive or negative interference in all cases but, in general, the application of an interference correction will improve the accuracy of oxygen test results sufficiently to justify its use.

With reasonably skilled operators test results can be duplicated within 0.003 cc of oxygen per liter. This can be accomplished if operators exercise good judgment in discarding samples that contain visible air bubbles, that become contaminated by handling or that may be incorrectly titrated. Obviously errors that are not discernible will persist in any test and tabulation of these expected errors and their magnitude with respect to this particular test method are:

Probable error	*Chance of occurring*
± 0.001	1 to 1
± 0.002	1 to 4
± 0.003	1 to 20
± 0.004	1 to 143
± 0.005	1 to 1483
± 0.006	1 to 15770

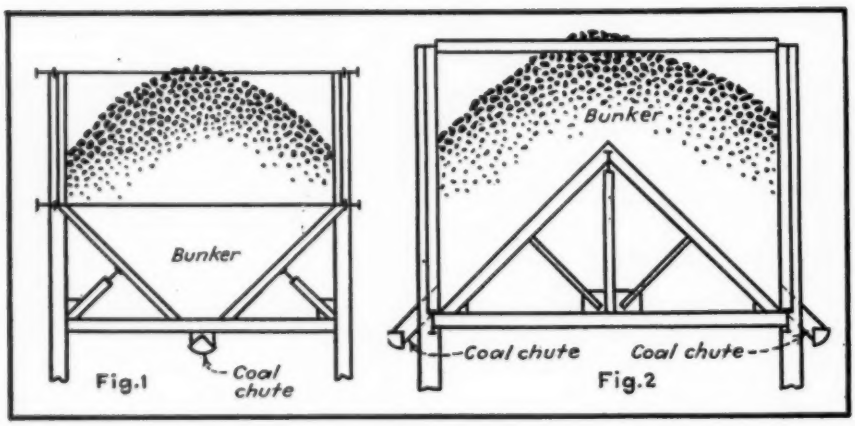
In general the test result is sufficiently close to the true quantity of dissolved oxygen present in the sample to be within the normal variation of any given set of test readings.

In the absence of dissolved oxygen in the interference sample it is suspected that small amounts of free iodine may be liberated, resulting in the analysis showing a slightly negative amount of dissolved oxygen for this condition of test. The magnitude of such negative results seldom exceeds the first probable error of the test and may be recorded as 0.000 cc per liter.

(*Continued on page* 166)

Match Design in Coal-Handling Equipment To Steam-Plant Needs

Wilbur G Hudson, material-handling-equipment engineer, draws on his long experience with design trends and compares their advantages and disadvantages for different types of installations



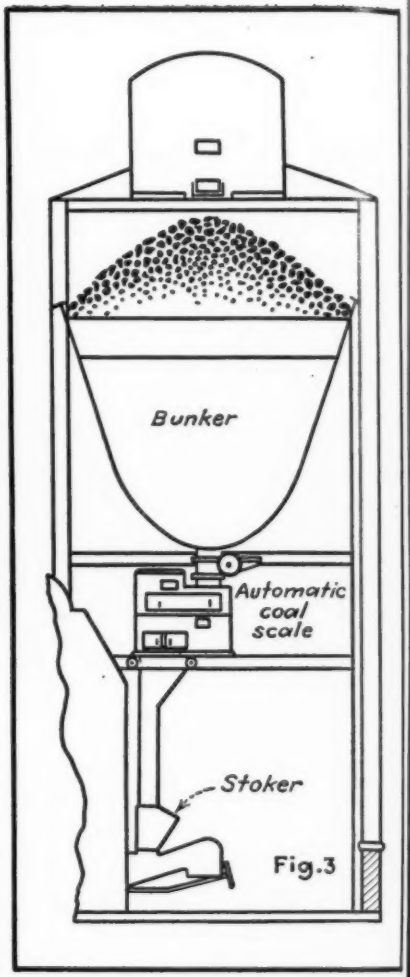


Fig. 1—Steel-framed-hopper bunker with center discharge. Fig. 2—Steel-framed bunker for a double row of stokers or pulverizers. Fig. 3—When large storage capacity is not first consideration a steel suspension bunker may be preferable

▶ ASIDE FROM MODIFICATIONS caused by WPB Order L-193, coal and ash-handling installations in steam plants show definite engineering trends. Notably, emphasis is on dustless operation, more general use of continuous-flow conveyors for coal, a trend away from the larry for distribution from bunker to hoppers, and changes in ground-storage methods. Major coal-handling units have changed but little in recent years.

Inclined belt conveyor. It is still preferred where delivery is far enough from the structure to use this equipment. It facilitates automatic weighing of incoming coal, and a magnetic head pulley can be installed to remove tramp iron that may have escaped the hammer-mill or Bradford breaker. Improvements are notable in belt construction and the use of anti-friction bearings on the rolls. Belt wear occurs primarily at the loading point, but can be substantially reduced by installing impact idlers formed with either cushion or pneumatic tires.

Automatic skip hoist. It has advantages for high vertical lifts or steeply inclined paths. Moving parts are few and maintenance is limited to replacing cables periodically and sheaves infrequently—both are comparatively inexpensive.

Continuous-bucket elevator. This heavy slow-speed unit holds its own, with few changes other than better chains. Maintenance involves an occasional replacement of a few buckets and eventually more costly renewal of chain pins and bushings. Since lubrication of chain parts is at best uncertain, extremely hard material greatly extends their life.

Continuous-flow conveyor elevator. In smaller plants, its application is quite common, Fig. 4 and 5. This machine has low first cost and simplifies the average layout. In its present development it is not suitable for capacities and heavy duty of larger stations. But with improvements that will undoubtedly be made when alloy-steel restrictions are removed, it probably will compete with the heavy-duty bucket elevator and skip hoist. Advantages of continuous-flow conveyor are that in one unit it combines automatic feeder and elevator, or elevator and conveyor; it eliminates dust; it has a slow speed, often as low as 30 or 40 ft per min compared to 180 ft, or higher, for the centrifugal discharge elevator.

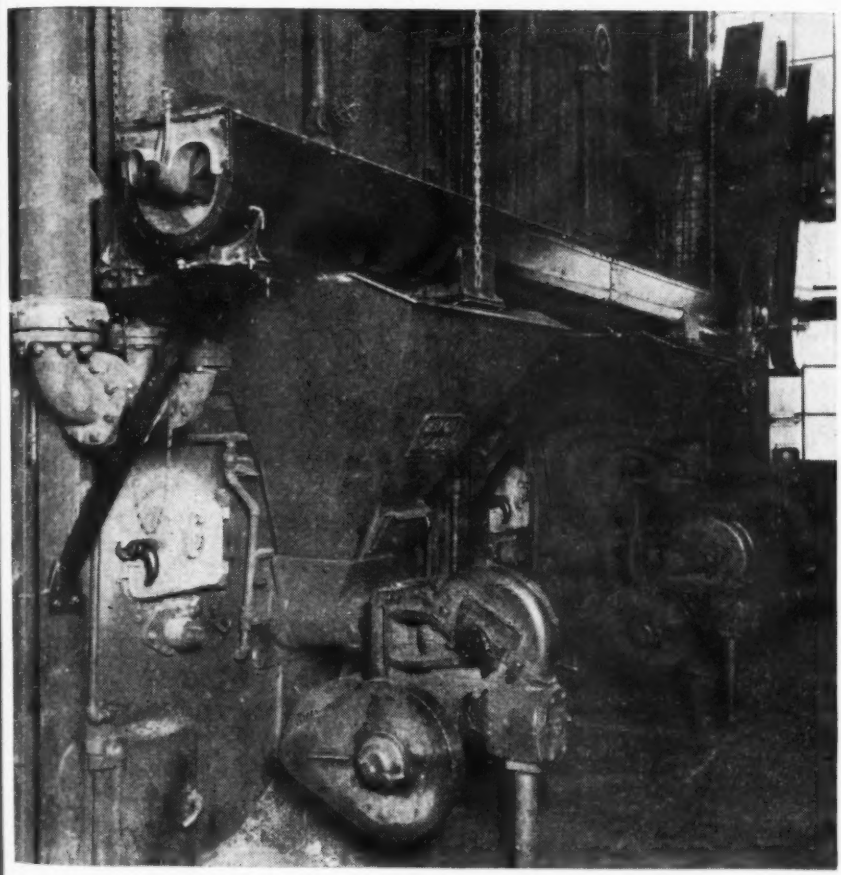
Unloading by crane. Plants that receive coal by water in open barges unload more often than formerly by crane, either pivoted or mounted on caterpillar treads. Improved hydraulic controls reduce operator's fatigue while increasing the unloading rate. Capacity

of one such machine, pivotly mounted, with 60-ft boom, 5-cu-yd bucket, 45-ft radius, 55-ft average hoist, and 90-deg swing, is about 375 tons per hour in free digging.

Unloading small-sized coal. Extensive use of small-sized coal has introduced car-unloading difficulties. Small screenings pack down in transit and hang up when hopper doors are opened. One power-plant engineer says two men often take an hour to empty a 50-ton car of ¼-in. coal when it is dry, and when wet, three men may take at least two hours. We get some idea of the difficulties in handling small coal by a comparison with dry mine-run coal: 6 men unload 8 cars per hour through a 12 x 12-ft track hopper, or 10 cars per hour through a double-track hopper.

Track-hopper valley angles. They should be steeper than normal for fine coal. A valley angle slope of 45 deg is not self clearing. Make track hoppers large, the larger the better. Double hoppers are preferable so loads may be dumped without holding up the next car in line.

Frozen coal. Because it is difficult to unload, a motor-driven accelerator, resembling a row of four vertical augers, which may be moved laterally, raised or lowered, or reversed in rotation, is available. In one installation this equipment reduced unloading time from 4 men an hour per car to 2 men and 27 min per car. Another accelerator consists of a gantry frame that carries two 4½-ton spuds, or heavy chisels actuated by double-action air hammers. When lowered into the car the chisels cut a passage through the coal and then slice it off. This machine also spots a car on the track hopper by lowering the spuds into the car and traversing the frame along the runway. Increased use of fine coal will make greater application of these machines desirable.



In small plants coal distribution from the storage bunker to the stokers may be by screw conveyors, but the residual beyond the last feed point must spill

Wet fine coal. Even when not frozen, especially if loaded in rainy weather, it hangs up obstinately and requires men inside the cars, unless rotary car dumpers are installed.

Coal bunkers. In large plants, a steel-framed hopper design is generally built in as part of the plant structure, Fig. 1. The inverted pyramidal sections with outlet opposite each boiler are to some extent self clearing. Usually sides have a 45-deg slope, but as in a track hopper coal even when dry will not always flow on this valley angle. Side slopes of 50 deg are preferable. Steel-framed bunkers require considerable steel per ton of coal stored but are well suited to large storage capacity and high surcharge. For twin rows of stoker or pulverizer hoppers, framed bunkers may be constructed as in Fig. 2. This requires a still greater weight of steel per ton of coal stored than a single row of hoppers. Unless provisions are made for shifting coal from one bunker section to another by a run-around conveyor, dead storage is considerable where spontaneous combustion may occur when one or more boilers are off the line.

Where storage-capacity size does not require steel-framed bunkers, the suspension design, Fig. 3, may be preferable and costs substantially less. Unless the outlets can be set close together, however, liability to corrosion from damp coal, as when reclaimed, increases. Corrosion may be retarded by using copper-bearing steels, by coating inside of bunkers with bitumastic paint or ¼-in. lining of bitumastic enamel. Corrosion of the inside surface of the bunker steel may be eliminated by a gunited sand-cement lining.

Suspension Bunkers

Another design of suspension bunker substitutes for the continuous steel plate, steel straps spaced about 3-ft centers on which rests a dovetailed corrugated 22-gage steel sheet. On this is applied the water-proof gunited sand-cement lining varying from 4 or 5 in. thick at the bottom to 2 or 3 in. at the top sides. This design costs more than the unprotected steel-plate suspension bunker, but less than with concrete lining. A number installed more than 30 years ago are reported still in good condition.

Several variations of the suspension bunker are: One design has spaced steel suspension rods on which rest bolted ribbed cast-iron sections. The latter resist corrosion and are easy to replace, but initial cost is high. Another design has a steel strap-supported bag of deeply channeled asbestos-protected metal without concrete lining. Still another has a bag of precast concrete slabs laid upon steel straps; it is free to move under changes in loading.

Width and depth of suspension concrete-lined bunkers have a limit because the parabola flanks tend to change shape with load, Fig. 6, and crack the lining. One of the largest suspension concrete-lined bunkers built has 3000-ton capacity and a 30-ft width

and depth. Lining is of 1-2-4 waterproofed concrete, 6 in. thick at the bottom and 4 at the top sides. Its side movement at full load is less than ¾ in., not sufficient to cause noticeable cracking of the lining.

Outside silo. Where a few hundred tons storage is needed, this type has advantages and disadvantages. Monolithic-concrete silo costs less than one half as much as an unlined steel-plate suspension bunker with its supports. But the usual silo with a small live storage, formed by an elevated sloping shelf or a hopper, requires double handling of a considerable part of the incoming coal from the lower to the upper section. If the coal tends toward spontaneous ignition because of air circulation up from the discharge gate a large clinker may be formed, which is difficult to remove.

Damp Coal Freezes

In northern latitudes a further difficulty with damp coal is that it may freeze in storage. A hollow-tile silo, reduces this trouble. For the average plant, hollow-tile or monolithic-concrete silo costs $12.00 to $18.00 per ton capacity. A concrete-stave silo costs less but is not as desirable. A steel-plate silo costs much more than the monolithic. An unlined steel-plate suspension bunker costs about $25.00 per ton of capacity as a rule, including the longitudinal girders and cross struts, but not the supports. Gunite lining to the thickness required for protection against corrosion, adds from 80 to 90¢ per sq foot of inside surface.

Weigh larry. Distribution of coal by weigh larry from overhead bunker to stokers or pulverizers had advantages, but it requires placing the bunker higher than for spout distribution, which means a higher building. The larry has the further objection of causing dust when loading and discharging, and many plants now insist on dust elimination.

Run-around conveyor. An alternate for the coal larry is the continuously operating slow-speed horizontal run-around conveyor beneath the bunker, a continuous-flow conveyor being best. Coal flows to the conveyor from any bunker outlet and discharges automatically to stoker chutes or pulverizer hoppers either directly or through automatic scales. This arrangement permits reducing bunker-structure height 8 to 10 ft below that for a larry.

In small plants coal distribution from the bunker may be by screw conveyor, as in the photo, or by a continuous flow conveyor, Fig. 5. Obviously with varying demand there is a residue beyond the last feed-out point which is spilled on the floor. Two corrections are a variable-speed drive or an automatic stop functioning when end-spill begins.

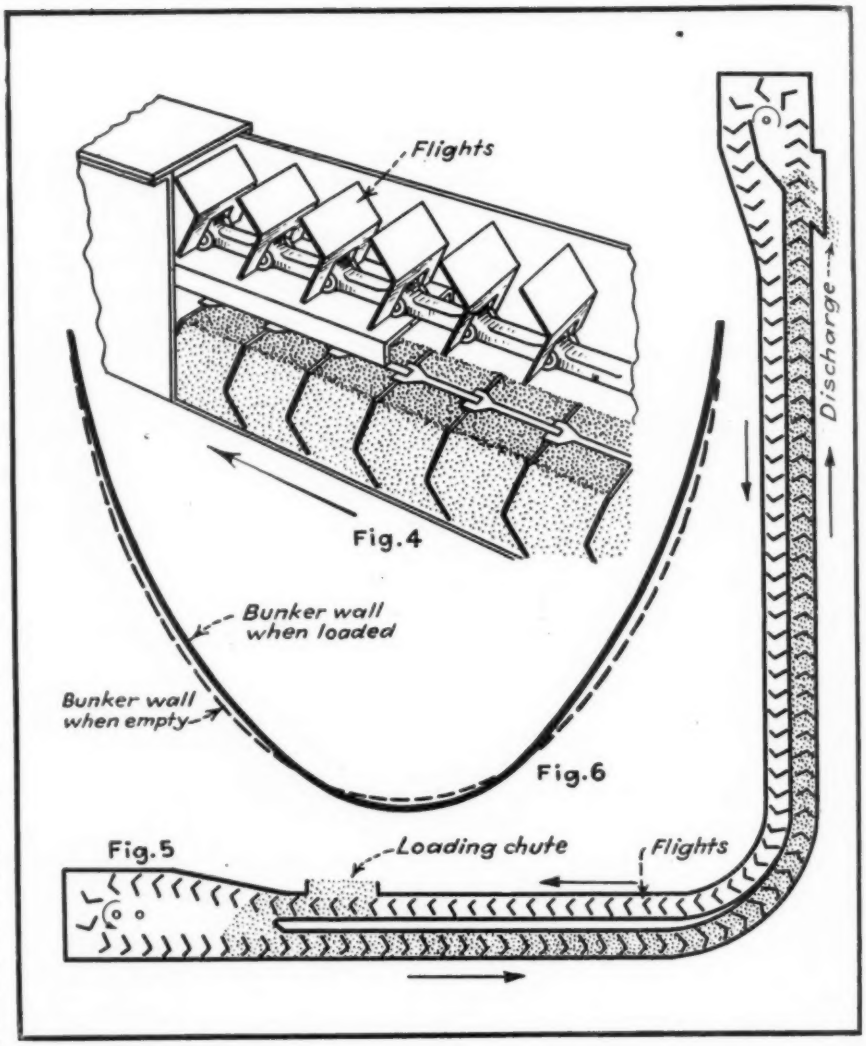


Fig. 4 and 5—In small plants application of continuous-flow conveyors has low cost and simplifies layout. Fig. 6—Width and depth of suspension concrete-lined bunkers are limited because parabola flanks tend to change shape under load

Reserve ground storage. Methods have changed because it is now recognized that it is not coal-pile depth that causes spontaneous heating, but air circulation through the pile. As a result, we have adapted the contractor's favorite dirt-moving machine, the bulldozer, for spreading out and compacting the pile. Layer storage, which means successive strata of compacted coal, has practically eliminated spontaneous ignition with many coals. Low-volatile West Virginia coals and anthracite give no trouble in storage but Midwestern coals or those containing finely divided pyrites may be troublesome, even in a pile a few feet deep.

If the pile is inactive, oxidation may be prevented by spraying the flank surfaces with a waterproof coating, such as emulsified asphalt. This practice has the added advantage of keeping the coal dry, which helps prevent freezing and reduces windage loss. Often oil-sprayed coal may be purchased to advantage. When stocked in piles it sheds rain, does not freeze deeply and reduces windage loss. It has a serious effect on rubber conveyor belts. Belts with synthetic rubber covers are immune to oil's destructive action.

A caterpillar crane with grab bucket is one of the best machines for handling reserve storage, especially when supplemented by a bulldozer. It is also available for other plant operations, as loading ashes brought outside the plant. While a grab bucket cannot be used in hopper-bottom cars with cross braces, such cars may be dumped into a track hopper having a floor sloping off to one side of the track.

Lineshaft Flywheels Produce Smooth Flat-Belt Operation

Difficult drive problems were solved, production increased and operating cost reduced by properly engineered heavy flat-belt drives in which pulley-flywheel applications and pivoted-motor belt-tension bases played important parts

By F C MORTON, *Chief Engineer*
Bickford & Francis Belting Co

▶ OBJECTIONS to severe momentary overloads of some power applications can be relieved by group-drive lineshafts with flat belts and flywheels. The latter store energy one moment for delivery to the load the next. Electric-motor-powered drop hammers are good examples of such applications, as demonstrated recently by Bickford & Francis Belting Co, Buffalo, N. Y., in installation of nine group drives. These serve 23 hammers from 2500- to 6000-lb capacity each, arranged in two's or three's, each group driven by a 50- or 100-hp 720-rpm motor.

Such hammers generally do not have sufficient flywheel effect (WR^2) in their pulleys to absorb load—that snappy lift action required for fast production. As a result, momentary shock loads are transmitted through the belts to lineshaft, motor and power lines. Thus, belts flap and slip and may come off their pulleys, and objectionable current and voltage pulsations occur on the electric power system. All these effects were eliminated in the nine new drives mentioned.

The diagram shows one of the small drives, but the arrangement applies equally to the large ones, except in equipment size. In the diagram a 50-hp 720-rpm motor on a pivoted base drives from a 16x16-in. pulley through a 14-in. heavy double-leather belt to a 62x16-in. pulley-flywheel on the lineshaft that operates at 184 rpm. Two 26x14-in. pulley-flywheels on the lineshaft connect by a 10-in. open and a crossed belt to the two 54x14-in. pulleys on each 2500-lb hammer. On the larger groups and for the heavier hammers larger pulleys and belts are used.

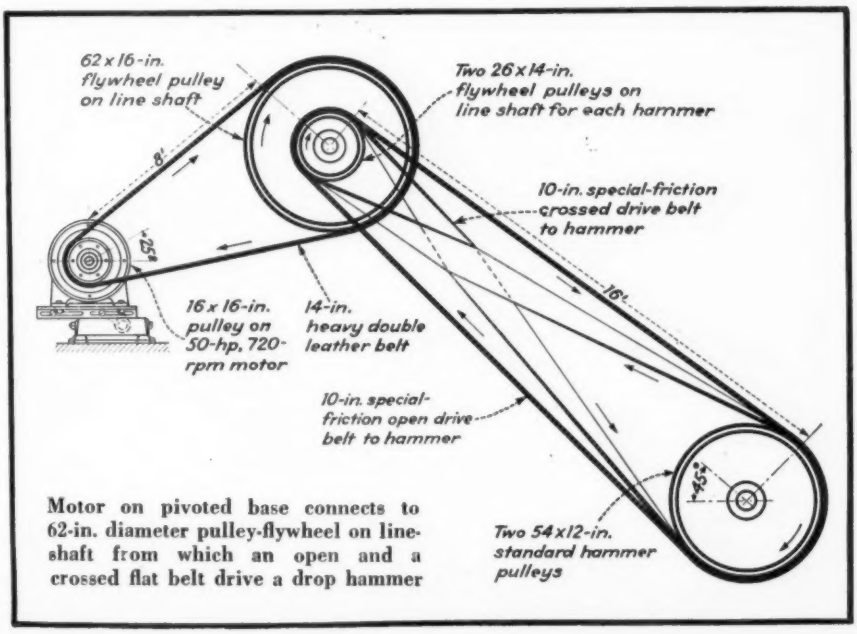
Connecting hammer and lineshaft pulleys by low-slip low-elasticity belts transmitted a large part of the shock load to the lineshaft. To absorb shock loads, lineshaft pulleys were designed as flywheels so calculated that they supply energy equal to about two thirds of the motor horsepower. Thus, the 50-hp motor runs at fairly constant load, one moment storing energy in the flywheels and the next being helped by them to deliver 80 hp to the hammer without overloading the motor. For the 100-hp drives the values are about double those for the 50-hp. Oversized lineshafts were selected to carry the pulley-flywheels and to absorb the shock loads. Ball bearings and hangers have extra heavy ratings.

Because the hammers are on solid foundations without vibration insulation, heavy ground vibrations cause building columns to wobble. Space restrictions required mounting the hammer motors on overhead platforms supported from building steel. To prevent oscillation of motors on their bases, care was taken in the equipment design to have the natural frequency of the motors on their bases and the belts well outside that of the motor platforms.

For the resilient element to take care of building vibration, our calculations showed that a proper selection of motor and pivoted base in combination with a leather belt would take care of the platform's vertical motion, and that lateral bracing would stop its horizontal vibration. This arrangement proved correct for, in service, motor frames remain still throughout the entire load range of one to three hammers, and they have a quick snappy action compared to the old drive's sluggish performance.

Production costs were decreased and in at least one case production increased 40%. Two large hammers operating side by side were used on one job. One hammer drew the stock one half, and the other completed the draw. With the old drives, the first hammer made the half draw and the stock was laid aside to be reheated and finished by the second hammer. With the new drives, the first operation is done so quickly that the hammer man immediately completes the job on the second hammer without reheating the stock.

This installation is an excellent example of how sound engineering and selection of mechanical-power-transmission equipment of ample capacity increases production, reduces operating and maintenance costs and insures high reliability in operation. When selecting mechanical power transmission equipment, a little extra investment in some excess capacity always pays big dividends, whereas an undersized drive may prove a source of trouble and expense.


62 x 16-in. flywheel pulley on line shaft
Two 26 x 14-in. flywheel pulleys on line shaft for each hammer
10-in. special-friction crossed drive belt to hammer
8'
25°
16'
16 x 16-in. pulley on 50-hp, 720-rpm motor
14-in. heavy double leather belt
10-in. special-friction open drive belt to hammer
45°
Two 54 x 12-in. standard hammer pulleys

Motor on pivoted base connects to 62-in. diameter pulley-flywheel on lineshaft from which an open and a crossed flat belt drive a drop hammer

Instrument School Trains

This pioneering school established in 1935 400 men annually to maintain and repair

► MORE AND MORE, American industry revolves around instruments and controls. When these fail production goes haywire. The four vital links in the chain of effective instrumentation are (1) proper selection (2) correct installation (3) good maintenance (4) intelligent interpretation of readings.

Selection and installation are one-time operations—generally well-handled because the maker can lend a hand without undue expense. With maintenance and interpretation, the case is different; the maker can't afford to camp on the user's doorstep to make certain that his instruments are well maintained and wisely used. Next best thing is to turn school teacher and show the man in the plant how to do this job for himself.

That's just what Brown Instrument Co (now a division of Minneapolis-Honeywell Regulator Co) started doing in 1935. The school it set up in Philadelphia at that time to train men in instrument repair and maintenance has flourished ever since. Today, three full-time instructors handle up to 40 students at a time, 400 a year. In all, the school has graduated nearly 3000 instrument maintenance men since 1935.

Students the World Around

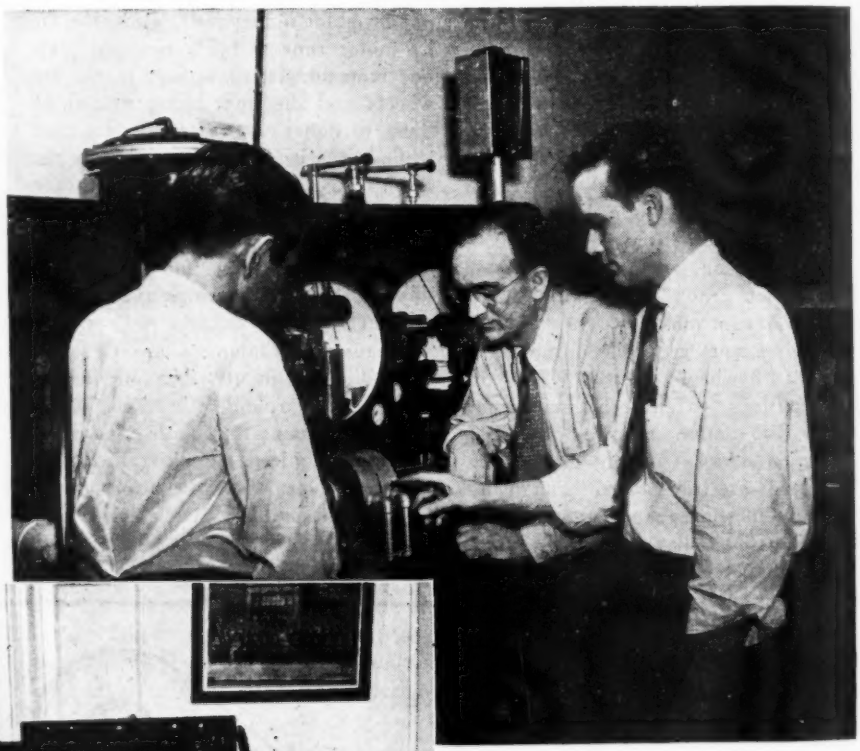
The Brown School teaches the art of maintaining and repairing all types of industrial recording, integrating and indicating instruments—pressure, temperature, voltage, flow, CO_2 and so on.

Students come from all over—mostly from the United States, but some from South America, Mexico, Asia, Russia, Iran, China. They include college graduates and many men with one or two years of college—also war veterans and occasional armed force personnel.

Ages range from 21 to 50. The ideal candidate is handy with tools and has had about two years of engineering school. Most likely he is something of an electrician. Entrance requirements are somewhat flexible, but candidates must have the "makings".

Some observers predict that hundreds of thousands of veterans will "go to school" after this war. Those at the Brown School include Clyde Lassiter, former waist gunner in a flying fortress. Injured when his plane cracked up during training, Clyde is now headed for a practical career in instrumentation.

Curriculum is "a la carte"—covers many different types of instruments.



Above—Instructor G G Walker (right) demonstrates flowmetering to Chas F Woods (center) of MHR Dallas office and Clyde M Lassiter, Atlanta office

Left—Mayer B Roberts (left) of the Minneapolis-Honeywell Regulator (MHR) Co's Chicago office, and Lawrence Daly, of Mathieson Alkali Works, Lake Charles, La., put the pieces together. Every student gets a lot of this down-to-earth practical instrument experience

Heads and Fingertips

by Brown Instrument Company trains about the common types of industrial instruments

You pick the ones you want to study, but must handle them in the periods for which they were scheduled.

Tuition is free, and students find good board and lodging at low cost in nearby rooming houses. There they burn the midnight oil learning their book lessons. By day they have a few lectures, but for the most part work directly on commercial instruments in the well-equipped laboratory.

Many of the students are sent to this school by the companies for which they work. Most of them get regular salaries while studying.

Top responsibility for the school lies with E M Robinson, manager of Brown's service division, Martin Ladden, supervisor of instruction, shares the teaching load with two instructors, J D Root and G G Walker. All three know how to teach, and have been "through the mill" of instrument maintenance and repair.

School hours run from eight to five, six days a week. The individual student may select courses running anywhere from one day to a full "semester" of four months.

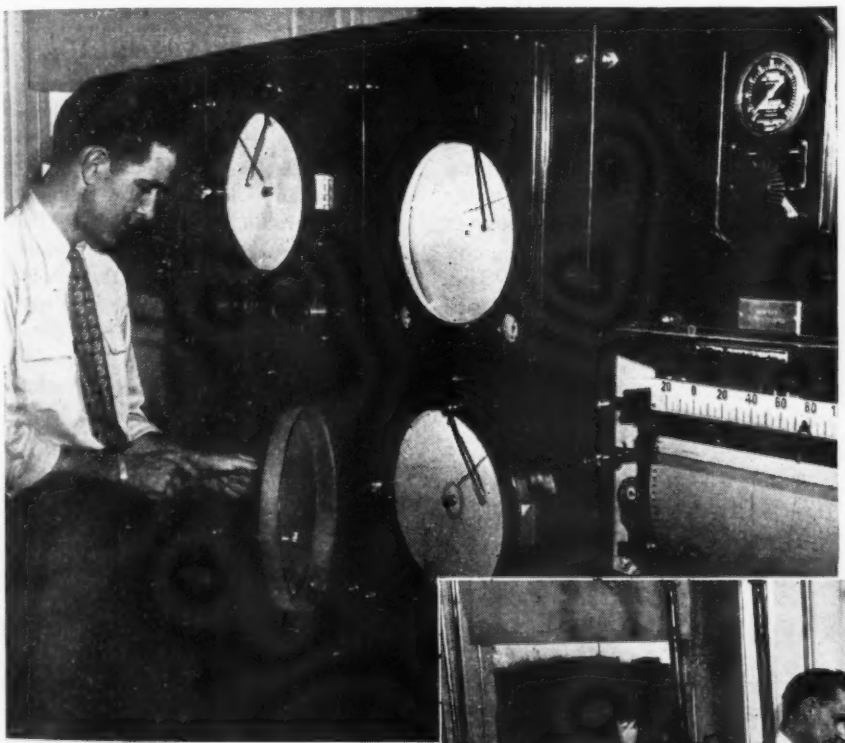
Each course ends with stiff exams. For one thing, the would-be "graduate" must be able to assemble the dismantled and shuffled parts of an instrument.

As in most good schools, lectures play a secondary role. All students get a little preliminary instruction in electrical fundamentals and a short talk on the history of instrumentation. More stress is placed on study of the texts and still more on laboratory work with actual instruments — testing, taking them apart, reassembling.

Future of Instrument Instruction

It seems certain that instruction in instrumentation will expand after the war. Other instrument companies may start courses along the line of Brown's. Colleges will eventually teach more about instruments, although it will take some time to train or find competent instructors.

Mr Robinson states his views this way: "I believe the day will come when the larger colleges and trade schools will include instrumentation as a major part of specific courses and will give this subject the necessary time demanded by its technical character and importance. Until that time arrives, industry must depend upon itself. It must initiate a program that will be wholly representative of the newer perspective for all private endeavor."



Above—Former waist gunner in a flying fortress, Clyde M Lassiter was injured in a crack-up—is now learning to maintain and repair the instruments of peace

Right—Left to right, this flowmeter crew includes H F Wittenmeyer, Phelps Dodge Copper Co, Elizabeth, N. J.; J D Root, instructor; Wm Englehart, MHR Atlanta office; Geo Gilliam, MHR Chicago office; Wm Saporetti; T R Harris, Merck Co, Rahway, N. J.

Pit 5 Adds 160,000 Kva to P

Operating with a static head of 630 ft, four new 40,000- of Pit River. Largest hydro plant in California will turn

▶ LARGEST AND NEWEST hydroelectric plant in California is Pit 5, with 160,000-kva capacity. On the Pit River, some 250 miles northeast of the San Francisco Bay area, which it will serve, this 52nd hydro plant of Pacific Gas and Electric Co's system is the largest, privately owned, west of the Mississippi.

The plant reflects the extensive experience of the company's designing engineers in hydro-plant development, as well as the war's restrictions on construction and equipment. The straightforward simplicity of the design is not occasioned primarily by the war but is, rather, in accord with the engineers' belief that long life, and economical and continuous operation are gained thereby.

The Pit River, which drains some 4800 square miles of Cascade Mountain watershed, has the largest and most even flow of any power stream in the state. Yet, this normal flow is far below the stream's flood potential, a factor which greatly influenced the hydraulic design. That is, the design provides for a maximum flow of 3300 cfs through the plant facilities, whereas the diversion dam can accommodate a flood flow of 75,000 cfs to be expected perhaps once in a hundred years.

The diversion dam is 300 ft long, with four 50-ft-wide gate openings, the gates themselves rising 26 ft. To lift each gate, an electric hoist with a 10-hp motor is installed in the superstructure above it. The gates are controlled by float switches which operate to lift them in stages, as required to pass such portion of the stream flow as cannot be used. Power for operating the gates is furnished by an 11-kv line from the powerhouse, with an auxiliary, engine-driven 50-kw generator to operate them when no power is available from the plant itself.

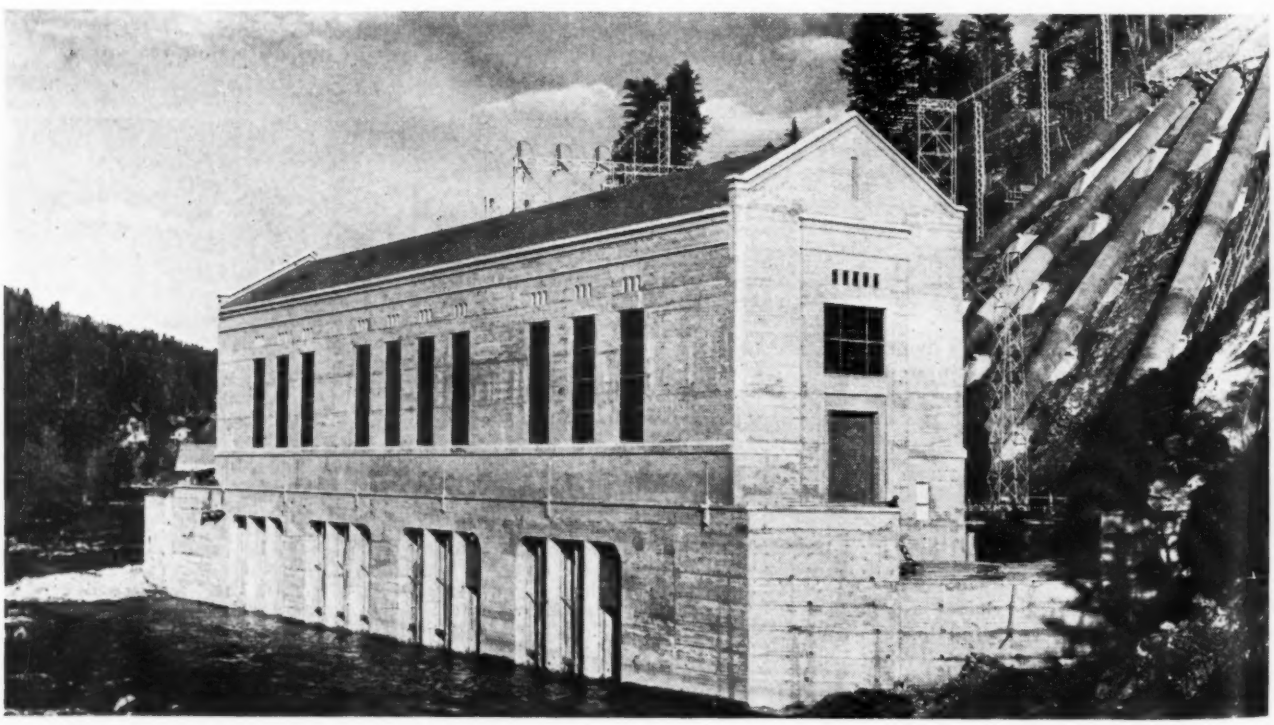
Tunnel Construction

Headwater intake is at an elevation 2060 ft above sea level, while tail water passes from the powerhouse at 1430-ft elevation, thus providing a static head of 630 ft. From the intake gate, water passes through a concrete-lined tunnel, 19 ft in diameter and 5000 ft long, and into an open basin-conduit system. This portion of the waterway is of earth-filled construction, protected by a concrete siphon spillway, with a capacity of 4100 cfs. At the lower end of the open portion, the mouth of a second 19-ft tunnel, 23,000 ft long, terminates in four penstocks.

Near the lower end of this tunnel is a surge chamber of tapered cylindrical form. It is 100 ft high, with bottom and top diameters 40 and 88 ft respectively. The tank has sufficient capacity to supply the demands of the units while the flow of the tunnel is being accelerated. It will not spill on normal rejection of load.

The four penstocks are about 1400 ft long, with a maximum diameter of 102 in. and a minimum of 90 in. They were assembled by welding together lengths of about 30 ft which had been arc welded in the shop and hauled to the site. Packed nickel-clad-steel expansion joints are used. Butterfly valves, hydraulically operated, in the penstocks near their head, may close from any one of these locations: (1) adjacent to the valve (2) from the control house or powerhouse (3) automatically, by the action of a flowmeter, if the velocity through the penstock becomes too great. On the other hand,

* *Pacific Coast Editor of* POWER. *Based on material furnished by J P Jollyman, E F Maryatt, E M Wright, B D Dexter and T J Corwin—all of Pacific Gas and Electric Co*



Five miles of 19-ft-diameter tunnel supply the four 102-in. penstocks with about 3300 cfs. Welds were radiographed

Pacific Coast Power Supply

kva units utilize full flow out 800 million kwhr per year

By E J STRICKLAND*

a closed butterfly valve can be opened from one and only one place—that adjacent to the valve. Bypasses around the butterfly valves are provided so that emptied penstocks can be refilled. Manholes permit access to the interior of empty penstocks, and tappings permit insertion of hose or wires at several points along their length.

Generator Arrangement

Four units, of 40,000 kva each, are grouped in pairs, making in effect a 2-unit plant. Each of the two pairs of generators feeds into its own 230-kv transmission line, and no provision is made for paralleling the output of the two groups of generators at generator voltage, 11,500 v. This design permits better loading on operating units when the plant is at partial load and minimizes the effect of line outage. It also tends to stabilize stream flow.

Each group of two generators feeds into an 11.5-kv bus, which is, in turn, connected directly to the transformer bank, where step-up to transmission voltage, 230 kv, is made. The transformers are connected, through oil circuit breakers, to each of the two transmission lines. Despite the fact that water is available for cooling, transformers are self cooled, the company's engineers believing that longer service life justifies the additional cost.

Power for station use is tapped from each 11.5-kv bus section, stepped down to 440 v. Switching arrangement for this power is such as to permit the load to be carried by either, or both, of the pairs of generators. Three reactors, 3 phase, 12,500 kva, for use when it may be necessary to charge a great length of transmission line from this plant, are arranged to use one, two or three reactors, as needed.

Generator units are driven by 50,000-hp, 300-rpm vertical francis turbines, each of which is designed for a flow of 825 cfs, with an effective head of 587 ft (static, 630 ft). Provided with stalling-type relief valves, of 950-cfs capacity, each turbine is governed individually, by an electrically driven flyball mechanism. Generators are surface cooled, of conventional design, 40,000 kva, 0.8 pf, 11,500 v. Bearings of both generator and main thrust are self lubricated and water cooled.

An unusual, war-occasioned feature of the turbines is the welded construction of the scroll cases; no manufacturer was in a position to make castings of the necessary size. This is believed to be the first use of a welded-plate case for a turbine with a working head this high. Because the welded case is not strong enough to permit mounting the servomotors directly upon it, in the usual manner, they have a separate concrete foundation.

Air Conditioning

Plant maintenance will be easier because forced circulation of filtered air is provided rather than natural ventilation. Partial heating or cooling may be obtained by circulating warm water from the generator cooling equipment or cold water from the tailrace through a heat exchanger. Switchboard rooms and offices are automatically air conditioned.

Because of the war, a minimum of new transmission line has been built. Since the distance from the power plant to the nearest existing available 230-kv lines is about 14 miles, two wood-pole lines have been built to connect with two existing 230-kv lines. When Pit 5 plant operates at full capacity, these lines, which extend southward,

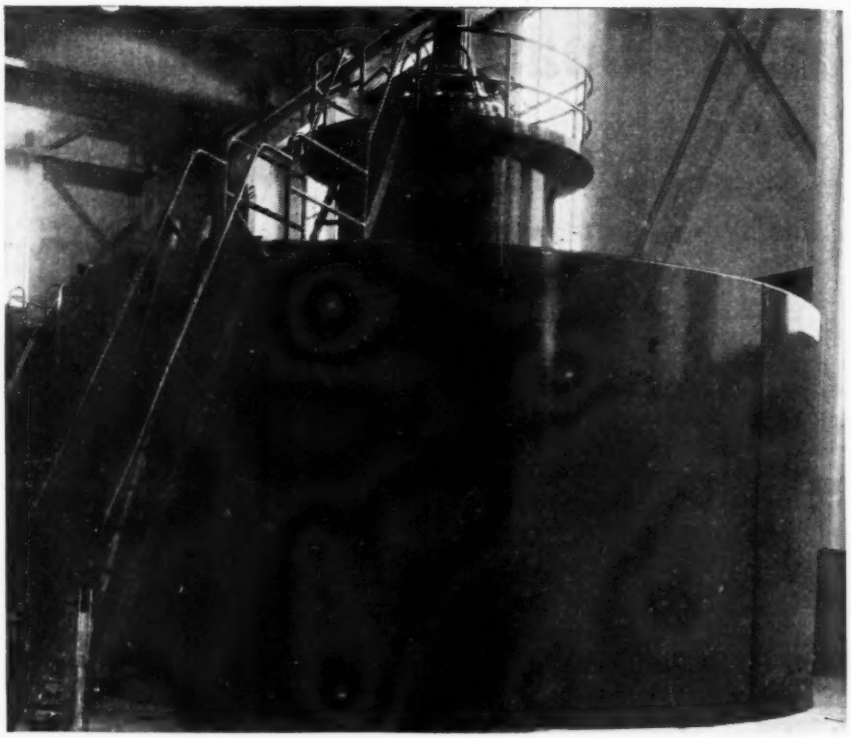
Diversion dam can handle a flood flow 25 times normal. Gates open only when power plant cannot use entire river flow

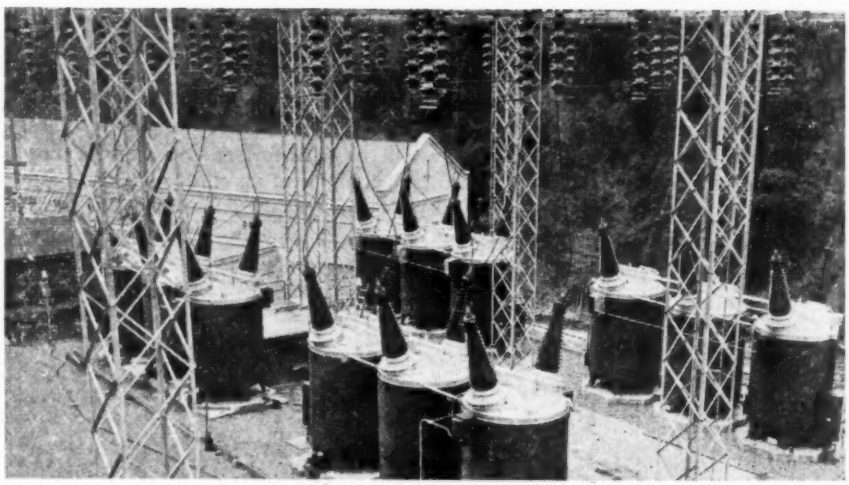
will be heavily overloaded, but this condition cannot be remedied until additional transmission lines can be built. The wood-pole construction, although made necessary by war conditions, is not new with Pacific Gas and Electric Co, since a similar line, 55 miles long, has operated in the same region for more than 20 years.

Reinforce System

Addition of Pit 5 power to an existing system made necessary the addition of substation capacity at several points. At the Contra Costa substation, east of San Francisco Bay, new transformer capacity, 90,000 kva, was added, and two 3-cycle 230-kv oil circuit breakers were installed. Added at the Newark substation were additional transformers and circuit breakers and two synchronous condensers, 35,000 kva. On the existing circuit between Contra Costa and Newark substations, some 66 miles, a carrier-controlled relay provides electrical protection.

Communication between the dispatcher, in Oakland, and Pit 5 powerhouse, 250 miles to the northeast, is telephonic, with carrier-current equipment, via a 100-kv circuit to Contra Costa substation, and the 220-kv circuit from Contra Costa to the powerhouse, the two circuits being audio coupled.





Above right—Each of four 40,000-kva generators is driven by a 50,000-hp 300-rpm francis runner in all-welded scroll case, new for high-head service

Right—Circuit breakers on 230-kv system are arranged to deliver output of two machines to either of two lines leading to San Francisco Bay area

Principal Powerhouse Equipment: Pit 5, Pit River, Calif.

Generators, 2.....General Electric Co
40,000 kva, surface cooled, .8 pf, 11,500 v

Generators, 2.....Westinghouse Elec & Mfg Co
40,000 kva, surface cooled, .8 pf, 11,500 v

Transformers, 7.....Westinghouse Elec & Mfg Co
27,000 kva, self cooled, single phase, 11.5/240 kv with taps

Transformers, station service, 6.....Westinghouse Elec & Mfg Co
500 kva, single phase, dry type, 11,500/440 v

Reactors, 3.....General Electric Co
12,500 kva, self cooled, 11,500 v, 3 phase

Turbines, francis, 4.....Pelton Waterwheel Co
50,000 hp, 300 rpm, 630 ft static head

Butterfly valves, 4.....Joshua Hendy Iron Works
102 in., 630-ft head, hydraulically operated

Butterfly valves, 4.....Pelton Waterwheel Co
120 in., 110-ft static head, hydraulically operated

Relief valves, with energy absorber, 4.....Pelton Waterwheel Co
5-ft dia, 630-ft head, 950 cfs

Lightning arresters, 6.....General Electric Co
220 kv, single phase, Thyrite 16 units per pole

Oil circuit breakers, 4.....General Electric Co
230 kv, 3 phase, 5 cycle, pneumatic operators

Oil circuit breakers, 10.....General Electric Co
11.5 kv, metal clad, 1,000,000 kva

Air break switches, 10.....Pacific Elec & Mfg Co
230 kv, 3 phase, 1200 amp

Storage batteries, 2.....Electric Storage Battery Co
60 cell, FM-11 Exide

Charging sets, 3.....Electric Products Co
15 kw, 140 v, diverter pole

Cranes, 2.....Judson
100 ton, 15-ton auxiliary, span 50 ft

Governors, 4.....(Woodward) Pelton Waterwheel Co
Oil pressure, cabinet type

Gates, diversion dam, 4.....Moore Dry Dock Co
Wheel type, 50 ft x 26 ft, 7 in., counterbalanced

Gate, intake, 1.....Pelton Waterwheel Co
Wheel type, 15x19 ft

Emergency power unit, 1.....King Knight Co
Gasoline engine-driven generator set, 66 hp, 50 kva

Switchboard, main, 14.....General Electric Co
Panels, bench and vertical front and rear

Switchboard, de, 5.....Westinghouse Elec & Mfg Co
Panels, vertical

Station service bus.....ITE Circuit Breaker Co
Cubicles, double bus, metal clad

Basic Gas-Turbine Plant And Some of Its Variants

Single-stage gas turbine and multiple combustion chambers hold promise of high efficiency for compact, simple power plants

By J K SALISBURY, *Turbine Engineer, General Electric Co* *

FUNDAMENTAL COMPRESSOR, COMBUSTION UNIT, TURBINE

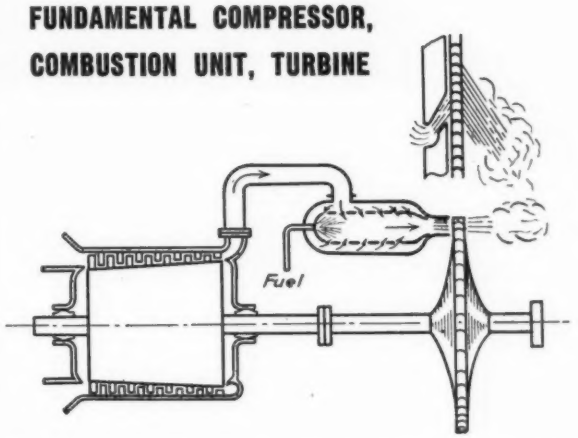


Fig. 1—Buckets of a single-stage gas-turbine wheel operate at temperatures well below those of the combustion chamber because of heat drop in gas-expansion nozzles

PRESSURE-VOLUME FLOW WITHIN STABILITY LIMIT

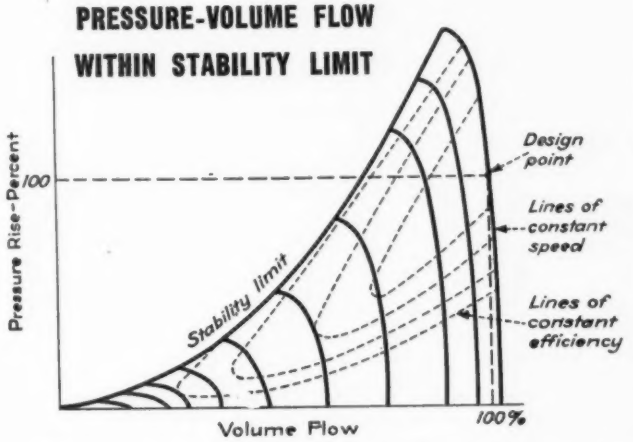


Fig. 2—Characteristic curves of axial-flow compressor are much steeper than for centrifugal types. Axial flow is essentially a constant-volume machine at constant speed

▶ WHEN DESIGNED for modern conditions of temperature and efficiency the gas-turbine plant is extremely compact, light in weight, and approaches the efficiency of other modern prime movers. This compactness and simplicity is, in fact, one of its outstanding virtues.

The axial-flow compressor is a comparatively new type of machine, hence, many engineers are not entirely familiar with its method of operation. Velocity diagrams may be drawn for the axial-flow-compressor stage in much the same manner as they are drawn for a steam-turbine stage. The conventional airfoil section, when arranged in a grid similar to turbine nozzles, possesses the property of deflecting through a small angle the fluid which passes through it. This property is utilized in increasing the pressure of the fluid.

The axial-flow compressor has over-all external characteristics of the type shown in Fig. 2. It will be noted that it is essentially a constant-volume-flow device at any given speed. Increase in the discharge pressure causes only a slight reduction in the volume flow passed by the compressor. Eventually, however, increase in the discharge pressure causes an excessively high "lift" of the airfoil sections and results in a sudden breaking down of their diffusing properties. At this time the compressor is likely to become unstable and destructive vibratory stresses may be set up. The dash lines are lines of constant efficiency, indicating that, as the flow and pressure are decreased, the efficiency also decreases.

Ship Propulsion

A good conception of the single-shaft gas-turbine power-plant arrangement is given in Fig. 3, which illustrates a design of a 3000-hp marine gas-turbine power plant having a single compressor and turbine unit. The multiple combustion chambers are arranged in juxtaposition to the turbine wheel itself, minimizing problems in transport of the high-temperature gases. Air enters the compressor at the left-hand side and, after compression, is passed through the rectangular ducts, past the exhaust hood, and into the annular space surrounding the inner liner of the combustion chambers. The latter are mounted at the end of the unit for easy accessibility in replacement if this becomes necessary. The relatively cool incoming air causes the liner to operate at a temperature considerably lower than the gas temperature. The hot gases pass immediately through an air-cooled nozzle to the turbine buckets, thence through the exhaust hood to atmosphere.

Many variables are involved in the study of a gas-turbine power plant. Oddly enough, this simplest of all power plants offers so many alternative methods of operation that a clear conception of the interrelationship of all the variables is rather difficult to obtain. In fact it is nearly impossible to present a clear, concise, graphical picture of *all* these variables in simple form.

The gas-turbine power plant in operation can be affected externally only by change of the fuel supplied or of the speed. The former can be controlled automatically or otherwise through a fuel pump or throttle valve, while the latter is controlled by the character of the load applied to the gas-turbine coupling. These two variables, that is, speed and fuel, therefore represent the most

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logical ones against which to consider the characteristics of the power plant.

Study of the data indicates a particularly favorable relationship between the power-speed characteristic of the gas turbine for best fuel economy and that encountered in marine applications. As the power is reduced, a reduction in speed is required if best fuel economy is to be obtained. This reduction in speed is very nearly equal to the natural reduction in speed which accompanies reduction in power for a propeller-driven ship. Obviously, in any application where fuel economy is important, some provision should be made for reduction in the compressor-set speed as the load is reduced.

It has long been known that regeneration is extremely efficacious in the gas-turbine plant because, when waste heat of the hot exhaust gases is used to preheat air discharged from the compressor there is a reduction in fuel required in the combustion chamber, and great improvement in fuel economy.

The term "effectiveness" has come to be used in connection with regeneration. A 50% regenerator would be a heat exchanger of sufficient surface to transfer to the combustion air just half the heat available from the exhaust gas if cooled from exhaust temperature to atmospheric temperature. A regenerator of 50% effectiveness would improve the fuel rate of a 1600-F gas-turbine plant about 20% at rated load on a calculated basis. Actual gain would be more nearly 15% because of pressure drops incident to gas passage through the regenerator. The surface, weight, and cost of a regenerator increase rapidly as the effectiveness increases, hence an economic problem arises in the choice of the regenerator effectiveness.

Lowers Pressure Ratio

The regenerator not only causes a reduction of the fuel rate but also a displacement of the lowest point of the fuel-rate curve to a lower pressure ratio than for the simple non-regenerative plant. Optimum fuel rate is obtained at the lowest air rate when a regenerator is used—not so for the simple plant. The air-rate curve is identical for both plants if no pressure drops exist.

In considering the possible applications of the gas-turbine power plant, one of the first questions likely to arise in the mind of the engineer is: "How does its efficiency compare with other prime movers?" Fig. 4 shows a comparison of the fuel rates of a gas-turbine power plant (designed for 6 atm pressure and 1600-F temperature) with steam plants and a Buchi supercharged diesel, all

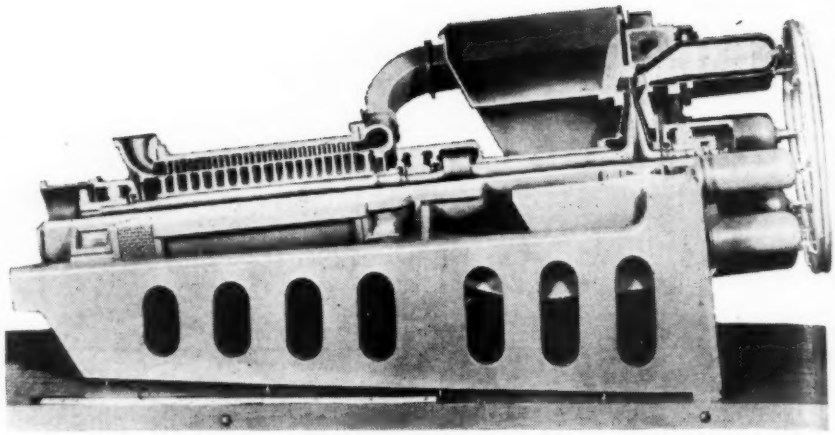


Fig. 3—Model of proposed 3000-hp marine unit with axial-flow compressor supplying air to multiple combustion chambers and a single-stage impulse turbine wheel

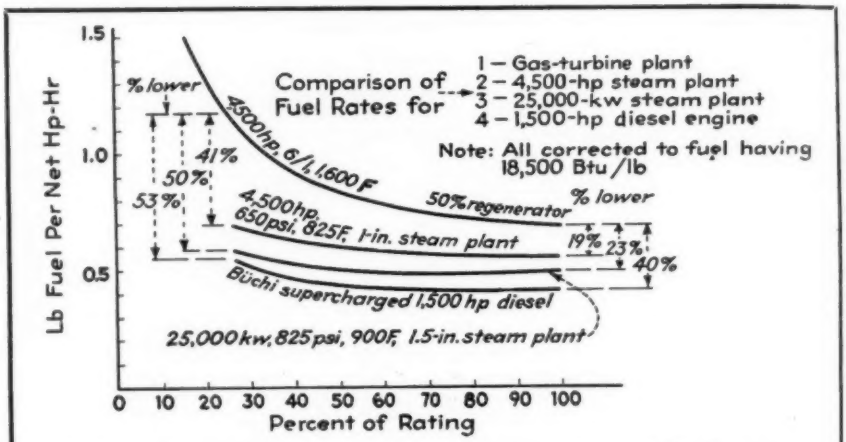


Fig. 4—Comparison of fuel rate for gas turbine, steam and diesel plants (assuming 80% blade efficiency for gas turbine and compressor) all corrected to 18,500 Btu per lb oil, power for auxiliaries included

corrected to the same fuel heating value. It must be emphasized that purely arbitrary values of compressor and turbine efficiencies have been chosen, namely, 80% at rated load. Pressure drops and auxiliary power have been taken into account. Increase of the efficiency level will rapidly reduce the fuel rate. For these assumptions, Fig. 4 indicates that both the steam plant and the diesel exceed the gas-turbine plant in over-all fuel economy. It must be remembered, however, that the present gas-turbine power plant has as its chief virtue, not good fuel economy, but rather simplicity, compactness, lightness of weight, and an almost complete absence of auxiliaries. In these it has no peer.

Although the diesel on first glance appears to be outstanding among the plants shown, several facts must be considered. While some diesel plants have been and are operating on heavier and cheaper fuel oils, by far the greater proportion of users prefer to use higher grade ash-free diesel fuel intended specifically for these engines. This fuel costs 50 to 75% more per heat unit than the bunker C fuel used in most oil-fired steam plants, and 3½ to 4 times as much per heat unit as coal. This cost, together with the lubricating-oil costs (which may be from 5 to 10% of the fuel cost) tend in great measure to offset the low fuel consumption. The best steam plants will equal the diesel's fuel consumption, but it must be remembered that in most cases they use low-cost coal and have a very low lubricating-oil consumption.

Dollar Efficiency

The gas-turbine plant seems to have more potentialities as a coal burner than the diesel. Actually neither is yet operating commercially in this country on coal, and some of the European efforts at burning coal in a reciprocating engine have been abandoned as not too promising. If the gas-turbine plant *can* be operated on coal its rather modest thermal efficiency can be converted into an excellent dollar efficiency.

As previously mentioned, the gas tur-

bine, in some respects, is well adapted to marine application. Fig. 3 illustrates a model of a 3000-hp gas-turbine power plant designed for marine use. This model is of a plant which did not include a regenerator. A similar marine unit, designed with an integral regenerator of 50% effectiveness will require considerable increase in physical size but also will show an appreciable improvement in fuel economy.

Provision must be made for maneuvering and astern operation in marine applications. For direct-current electric drive, the high torque requirements at the time of reversing can be met by maintaining nearly full speed on the set. Reversing can, of course, be accomplished electrically. Another very promising arrangement for marine applications is the variable-pitch or preferably, the reversible-pitch propeller. Use of this device permits independent control of the gas-turbine-set speed, thus allowing the operator to obtain best thermal performance from the gas-turbine set at all times, and greatly facilitating the maneuvering problem.

Central Stations

A question is often raised as to the applicability of the gas-turbine power plant for central-station power. Where fuel economy is of paramount importance, it is obvious that the oil-burning gas-turbine plant is not, in its present state of development, competitive, except in special cases such as where lack of water, cheap fuel, etc, make it attractive. It is attractive as a standby plant, such as the Neuchatel bombproof plant constructed in Switzerland because of low fixed charges, quick starting ability, and its small space requirement. When operated at the constant speed required in central-station use, the fuel economy of a single-shaft unit is not as good as when the speed can be reduced. The large volumes of air required tend to limit the rating of gas turbines to values which are lower than present steam turbines by rather wide margins. The gas turbine is usually considered not to be a competitor of the large, efficient steam plant, but rather as complementary, in its position as a reliable simple prime mover of intermediate capacity.

Aircraft Propulsion

The experience of the present war has indicated that the future range of size required for aircraft engines may be from 2000 to 8000 hp. Since cooling water is not available in aircraft use without large radiators, the steam plant, which is essentially heavy anyway, is probably not of too much significance. The light-weight internal-combustion engine seems to be approaching a rather definite limit in rating. The gas turbine on the other hand just comes into its own in the sizes at which the gasoline engine seems to be approaching a limit. Furthermore, it does not require expensive high-octane fuel for its operation. It is quite apparent to any thoughtful engineer, therefore, that one potential field for gas-turbine application is in the postwar cargo- and transport-plane field.

Another extremely fertile field for exploitation of this new prime mover is in land transportation. The Swiss Federated Railways already have in operation a 2200-hp gas-turbine locomotive. The Swiss locomotive power plant was designed with rather modest operating conditions and has shown in actual operation, with varying load, etc, a thermal efficiency of about 11.4%. Although this efficiency is not remarkable in ordinary practice it is quite high when compared with the reciprocating steam locomotive which has long occupied the attention of locomotive builders.

The author's company has recognized the particular adaptability of the gas-turbine plant to locomotive design and has made rather extensive studies of a 4500-hp locomotive using a single gas-turbine unit (with a regenerator and waste-heat boiler) as the motive-power source. The thermal efficiency of this locomotive, its ease of assembly, accessibility, lightness of weight and smooth flow of power, all indicate that it is an attractive application. Fig. 5 illustrates a 4500-hp oil-burning power plant in a single cab. All axles are motored, and the power per ton of weight is considerably higher than an equivalent locomotive employing other prime movers. All equipment is accessible, despite the use of a regenerator for fuel-economy reasons and the waste-heat boiler.

Steam Starting

The waste-heat boiler, mounted above the regenerator, serves, when equipped with separate firing, to start the gas-turbine plant by supplying steam to the gas-turbine wheel. It can also generate train-heating steam on waste heat, in passenger service, or be used for a power "boost" in freight service, under special conditions. The gas-turbine plant is geared, through double-reduction gearing, to two tandem-mounted direct-current generators, which permit speed control of the gas-turbine plant for best fuel economy. Another feature of the gas-turbine locomotive, which has interesting possibilities for mountainous terrain, is dynamic braking. Reduction of the fuel supply causes the output of the plant to become negative. The work of air compression is then easily dissipated to the atmosphere.

Undoubtedly, the gas-turbine plant will continue to be used in various oil-refining processes, and as a supercharger for boiler furnaces. What new uses will develop as time goes on depends only upon the ingenuity of application engineers, together with the zeal and courage employed by development engineers in perfecting this most recent and attractive prime mover.

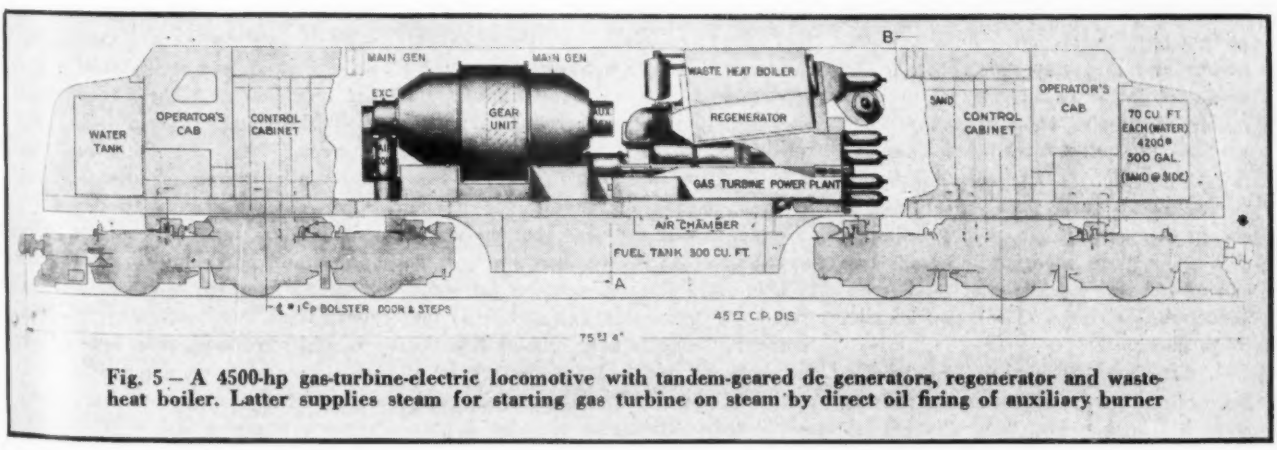


Fig. 5 — A 4500-hp gas-turbine-electric locomotive with tandem-geared dc generators, regenerator and waste-heat boiler. Latter supplies steam for starting gas turbine on steam by direct oil firing of auxiliary burner

THE OLD CHIEF

UNCIVIL WAR

A fine spray shot over Nosey's desk and wicket

Yesterday's simple arguments start up tomorrow's blasts and counterblasts, which are usually on the impolite side. Another in the distinctive series by William Doran, chief engineer, Essex County Sanatorium, Windsor, Ontario, Canada

IT HAPPENS even in the best-regulated power plants that petty quarrels, misunderstandings and other minor excursions and alarms rear up and, for a while, mar the peace and harmony of an entire organization. These events, at one and the same time, provide the most delightful gossip for all the old fogies about the place. In this connection, I recall a time when some of the young men in the shipping room rigged up a shower for themselves in a corner of the shop. It consisted simply of a tee, a globe valve and a homemade shower-head. To the hot and cold faucets below they had run two lengths of garden hose.

A day came when the globe valve was closed and the valves on the faucets were left open, which naturally played some merry tricks with the plant's supply of hot water.

The shop would phone that there was "no hot water." The engineer would check the temperature in the tank, feel the trap and the recirculating pump, and give his opinion that they were crazy. Ben, the maintenance man, was pulled off some job and sent up to double check. He reported back that the water was scalding hot. While he was making his report, the phone rang again with the news that the water was *stone cold.*

This sort of thing went on for some time until the water was as hot as the tempers at one minute and as cold as the sarcasm the next. A remark by a wall-eyed boy, "Our shower is cold, too," drew attention to the bypass caused by the open faucets and quickly restored peace.

Sometimes a simple argument or a verbal spat would start up a feud that would last for months. I remember that at one time a number of the men used to eat their lunch in the outer reaches of the time office. One of that number was Mr. Molesworthy, the tool-crib man, who had a large, bulbous nose and a reputation for being quite a wit. Another of that crowd was Slim Jim, the steam fitter, who was six feet, six inches tall and the thinnest man I ever saw. Neither one ever agreed with anything the other said. One day Molesworthy winked at the crowd and in a loud voice said:

"Slim, I believe that you have a brother in Boston who is a little taller than you but not quite so stout."

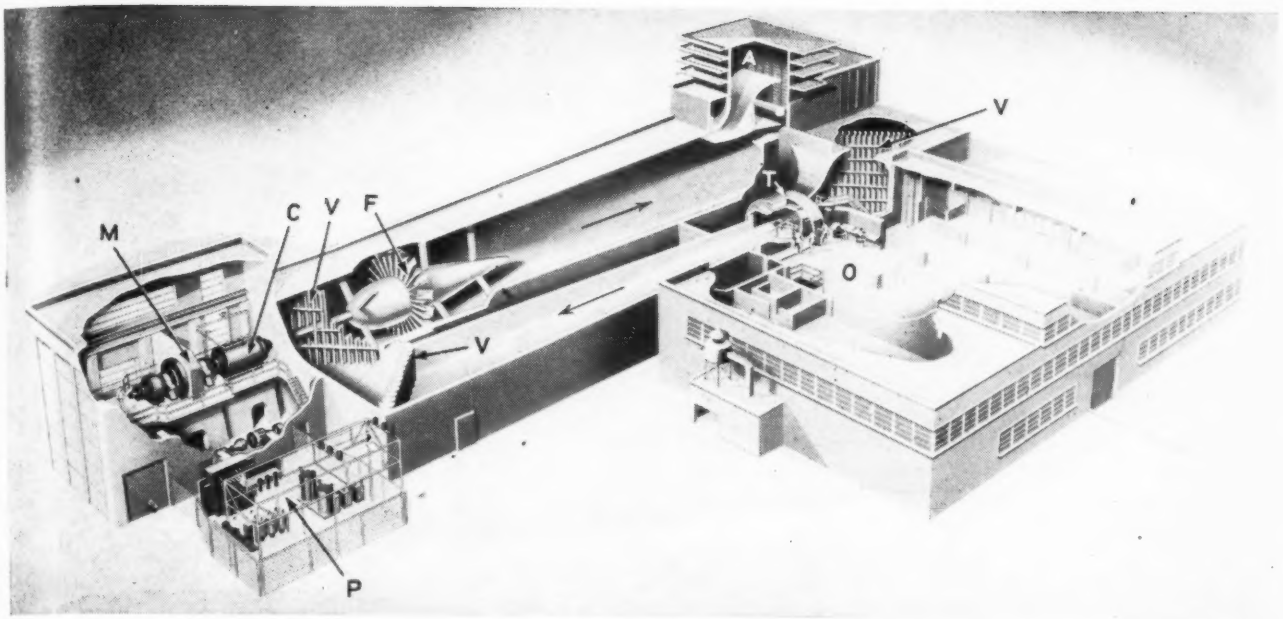
The Retort Uncourteous

Everybody perked up for the reply that was not long in coming. Slim shook his head. "You are mistaken on that point as you are on many things, *Mr. Noseworthy.* You see, it is not always the man with the most *nose* that *knows most.*"

I don't know whether it was the nickname he coined or the laugh that followed that started the war between them, but it became a source of daily interest. Slim would find a very, very dead mouse in his overalls pocket. Next day, cleverly hidden smoldering punks around the tool crib would make life miserable for Noseworthy. When Slim wanted tools, only the most worn-out flea-bitten ones were available. A water leak near the tool crib that Slim was fixing would be maneuvered until a fine spray would shoot over Nosey's desk and wicket for the best part of a day. Someone would put powdered graphite under the band of Slim's cap so that he would unconsciously walk around looking like a Borneo head-hunter. Nosey would reach up for a tool that Slim wanted, only to have a pail of water descend on his head.

So it went on, each side making life miserable for the other, until one evening they met at a chess tournament at the YMCA and discovered their mutual interest. That put them on a plane above all ordinary people. Thereafter they were the best of friends.

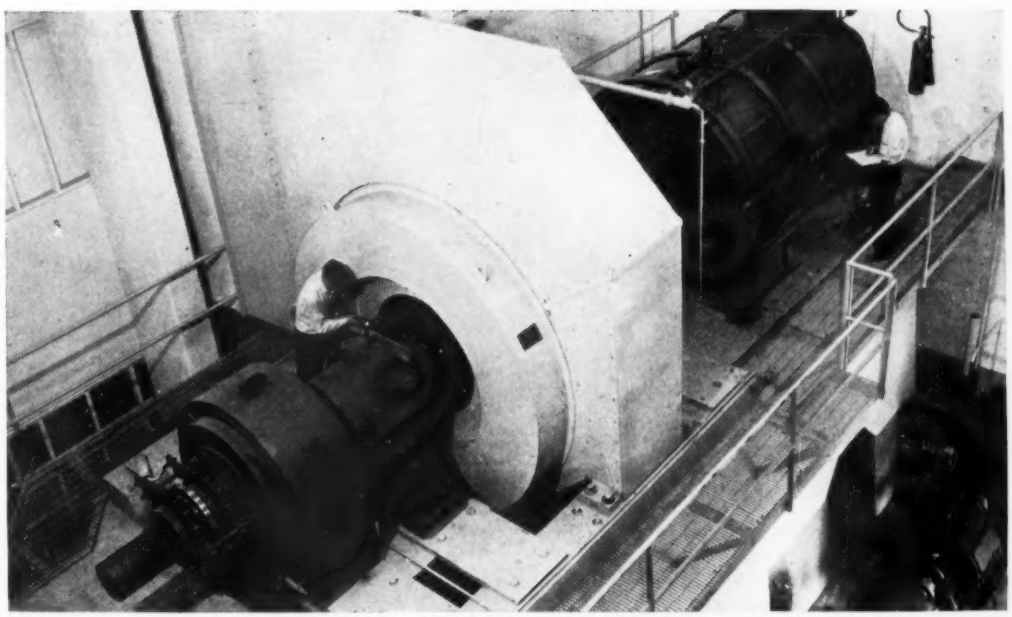
It is pleasant to reflect that practical joking and horseplay of this kind have vanished from the land and that safety committees have outlawed this dangerous and sometimes fatal type of humor which bodes no good for either man or organization. May they long continue to discountenance it.



Wind Tunnel. A 24-ft 16-blade fan, driven through a magnetic coupling by an 18,000-hp synchronous motor, at a top speed of 490 rpm, produces wind velocities of over 700 mph in this model airplane-testing wind tunnel, which is part of the Edmund T Allen Aeronautical Laboratories, of the Boeing Aircraft Co., Seattle, Wash., named for the late internationally known Boeing test pilot and scientist.

M—18,000-hp synchronous motor; *C*—variable-speed magnetic coupling; *V*—vanes at tunnel corners to change airflow direction; *F*—24-ft fan with laminated spruce-wood blades has a 37,000-ft-per-min (420-mi-per-hr) tip speed at 490 rpm; *A*—interchange tower where 11% of air is expelled and replaced every round trip, which at maximum velocity requires only two seconds; *T*—8x12-ft throat section in which 11-ft airplane models are tested in wind velocities of over 700 mph; *O*—laboratory-operating room; *P*—power yard.

18,000-Hp Fan Kicks Up A 700-Mph Hurricane



Driving Motor. This recently installed 18,000-hp 514 rpm Westinghouse synchronous motor whips up a 700-mi-per-hr hurricane inside a new concrete wind tunnel by driving a 16-blade fan, 24-ft diameter, in the aeronautical laboratories, above, which are the largest operated by a private aircraft company. Motor connects to fan by a magnetic coupling and a 10-ton shaft 37 ft long and 16-in. diameter. A 400-hp wound-rotor starting motor, left, brings the main motor up to nearly full speed before connecting it directly to the power supply.

(*Continued on page* 98)

The Riley Steel-Clad Boiler Setting

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

It will pay you to visit modern Riley Installations

makes a beautiful job, doesn't it?

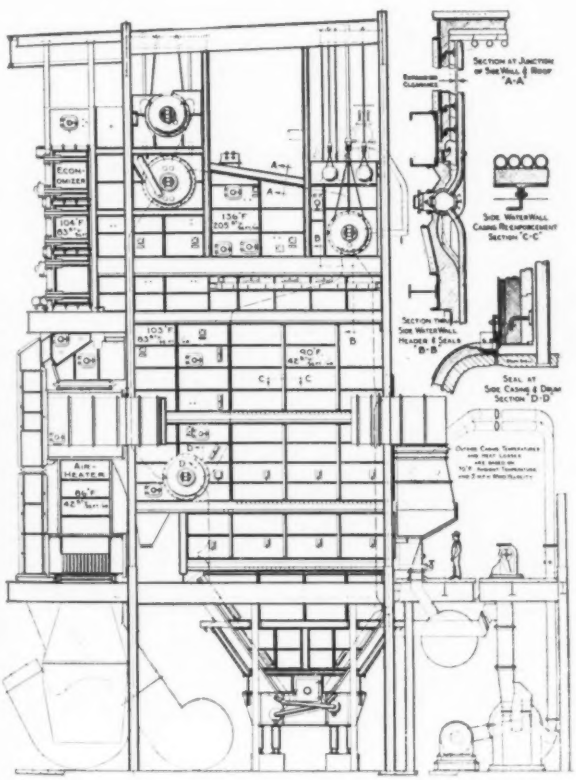
however its use is dictated by dollars and cents logic

A steel casing for boiler settings cannot be economically justified from the appearance standpoint alone. It must bring about dollar savings through lower operation costs.

There is no question but that the flanged steel casing used with Riley Units is expensive to manufacture and erect. However, this additional expense over the cost of the common brick settings or the batten strip type of casing is well justified by the operating savings resulting from this superior construction.

One of the main requirements of the steel casing is to assure complete and permanent air tightness. A tight casing prevents air infiltration which causes lower efficiency and higher fan power. A tight casing, by preventing these losses, is fully justified. Air tightness is assured in the Riley casing through the use of flanged joints and metal to metal seals. Experience indicates that flanged joints are absolutely necessary to assure permanent air tightness. The degree of tightness of the Riley casing is indicated by the fact that CO_2 decreases less than ½ of 1% between furnace and induced draft fan.

But air tightness is not the only advantage of the Riley Steel-clad Insulated Setting. The Riley Setting also assures low radiation loss, practically eliminates setting maintenance, assures against setting damage, and presents an excellent appearance. The quality of design and workmanship of the Riley Steel-clad Insulated Setting reflects the engineering care with which the entire Riley Unit is designed and constructed. A design which has exceeded the generally accepted standards for modern steam generating units.


Section at Junction of Side Wall & Roof "A-A"
Side Water Wall Casing Reinforcement Section "C-C"
Section thru Side Water Wall Header & Seals "B-B"
Seal at Side Casing & Drum Section "D-D"
Econ-omizer
Air Heater

Advantages of the Riley Steel-clad Insulated Setting. . .

1. Complete and permanent air tightness
2. Low radiation loss
3. Permanency—low maintenance
4. Strength to withstand high internal pressures
5. Elimination of internal setting leakage
6. Proper expansion provision

Riley Steel-clad Insulated Setting recently installed in connection with a 450,000 lbs/hr Riley Blast Furnace Gas and Pulverized Coal Fired Steam Generating Unit—the largest boiler unit in the iron and steel industry.

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

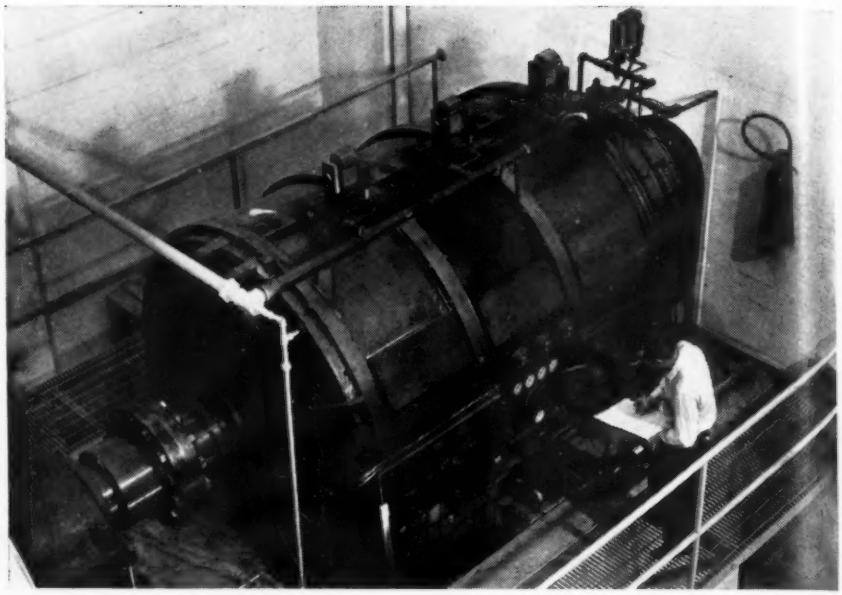
BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

before purchasing Boiler or Fuel Burning Equipment

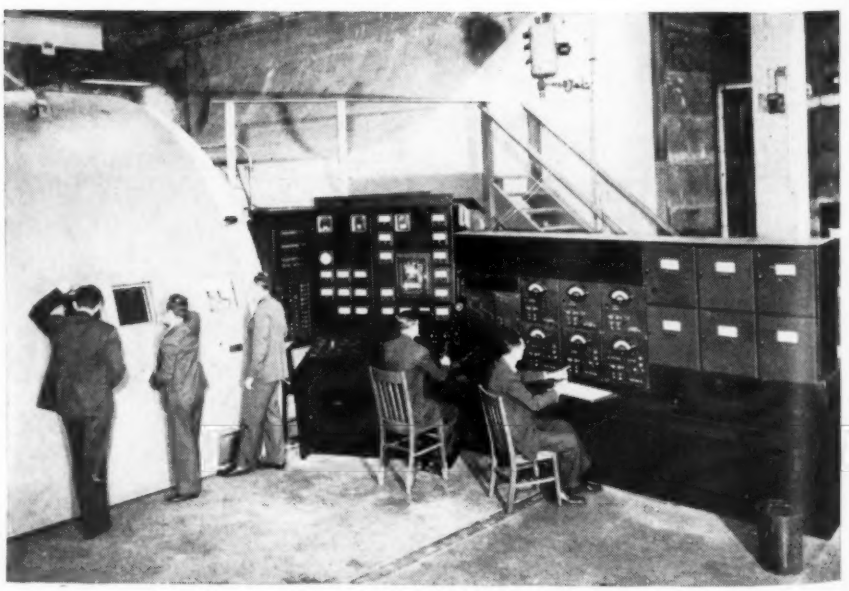
Fan Kicks Up Hurricane

(*Continued from page* 95)

Magnetic Coupling. Installed between the 18,000-hp motor and the 24-ft fan, this Dynamatic Corp variable-speed water-cooled magnetic coupling regulates fan speed to produce anything from a gentle zephyr to a 700 mph hurricane so that airplane models or parts are subjected to exact wind conditions. Inside the coupling are two revolving metal rings with no mechanical connection between. One ring connects to the motor and is magnetized to drive the other ring, keyed to the fan shaft. Speed is adjusted by changing magnetizing current in the coupling, which is several times larger than any coupling of this type previously built.



Test Section. The wind tunnel bore is a continuous return reinforced-concrete structure which follows a rectangular course 450 ft long varying in cross-section from 27.5x27.5 ft to 8x12 ft in the test or throat section, shown on the left. When the fan operates at top speed, air completes the 450-ft circuit in less than 2 sec. Under maximum operating conditions to keep the air in the tunnel cool, 11% of it is expelled and replaced with fresh air each round trip. In the throat section, airplane models with 11-ft wing span are installed as shown and tested.



Operating Room. Engineers outside the throat section of the wind tunnel observe action of an airplane model under test while other engineers watch its performance on indicating and recording meters. An intricate system of balances measures with close accuracy lifts from 0.1 to 8000 lb and records all the forces, such as lift, drag, yaw, pitch, roll and side forces acting on the model being tested. An ingenious automatic printer on the control board will, at the touch of a button, record on a tape all forces acting on the model at the instant the button makes contact.

FREE ENTERPRISE

The Obligation of Management and Labor to Cooperate... in War... in Peace

The Invasion is on! We have unleashed our full might for military victory. We have confidence that our great strength will bring success. We are strong because we have achieved unity in mobilization and in combat.

Though victory appears assured, we cannot rest until we have done everything in our power to speed the day when death and destruction are halted.

The home front is an important factor in this time element, for the fighting power of our Armed Forces depends upon their weapons. Napoleon's army fought "on its stomach"—man against man. Eisenhower's men fight on their tonnage—tanks, artillery, machine guns, heavy bombers.

As never before in the long succession of wars, the legends of heroic deeds on the battlefronts in this world conflict will be paralleled in history by the great accomplishments on the production fronts. Along with these heroic achievements of our Armed Forces, the world will long remember the record of our production accomplishments which have made us the stongest military power in the world, as well as the arsenal of democracy.

As the conflict reaches its climax, as battles grow fiercer and more destructive, our responsibility becomes greater and more critical. We must coordinate our productive efforts with the same ingenuity and the same precision with which our Armed Forces have coordinated theirs. We dare not waste the productivity of a single man or machine in these critical days.

As our landing craft are discharging our fighting men on the beaches of Europe and the Pacific, they must not want for equipment. No interference with war production for any reason can be justified. There must be no picket lines in America!

The landing of American troops in France virtually has stopped all strikes in the United States. This is important and encouraging news because the prelude to invasion, unfortunately, has been an epidemic of strikes. Time lost through strikes, during the first four months of 1944, was double that lost during the same period last year. April saw more strikes than any other month since Pearl Harbor, and in May the record again was broken. Here is what happened within two weeks in May:

> Nine thousand men in six Chrysler plants in Detroit were out when a jurisdictional dispute in a "soda pop" war between the American Federation of Labor teamsters and the Congress of Industrial Organizations fired their discontent.
>
> A three-day sit-down strike occurred among 950 employees in the B. H. Aircraft plant over the refusal of the company to discharge a superintendent unsatisfactory to the union.
>
> Thirteen hundred men in the Chevrolet transmission and axle plant at Saginaw struck over a no-smoking rule and a change in shift-starting time.
>
> Two thousand employees at the Browne and Sharpe Manufacturing Company walked out when a woman was hired to fill a job long held by a man.
>
> Production of penicillin, blood plasma, and other medical supplies was halted at two Detroit plants of the Parke Davis Company as 1900 employees struck for a ten-cent raise.
>
> Over 25,000 lumber workers in the Pacific Northwest struck because the War Labor Board denied their demand for a wage increase.

At the end of the third week of May, 70,000 workers in 26 plants in Detroit were idle because of strikes.

Strikes in Detroit alone reduced production as much as a moderately successful German air raid would have done. Far more important than their effect on output is the effect of strikes upon national unity and morale. To our home front and to our Armed Forces, strikes belie our pledge to back the attack with all the power at our command. Hence, strikes limit our all-out war effort.

Prompt and decisive action is needed to keep America free from strikes for the remainder of the war. Stoppages of work on the production lines cannot be condoned while lives are being lost in fighting the enemy.

Most union leaders realize this need and are preparing to impose discipline upon their members who violate the no-strike pledge. The Warehouse Division of the International Longshoremen's and Warehousemen's Union (C.I.O.) recently declared: "Strikes in this time of war are treason against the nation and betrayal of the interests of labor." A message sent by William Green to all heads of American Federation of Labor unions stated:

> "D-day is here. From now on until Hitler is finally crushed, every worker enrolled in the army of production must consider himself a part of the invasion forces of the United States and conduct himself accordingly. I call on you in the name of the American boys who are risking their lives under enemy fire to maintain uninterrupted production under any and all circumstances. Until victory is won every worker must give the same all-out service that our Armed Forces are giving on the field of battle."

Strongest of all was the appeal of R. J. Thomas, president of the United Automobile Workers, to members of his union:

> "Our union cannot survive if the nation and our soldiers believe that we are obstructing the war effort . . . there can be no such thing as legitimate picket lines . . . I appeal to our membership. If you value your union, if you want to live and serve after the war, we must restrain ourselves and our hot-headed brothers today. If we do not, there will be no union after the war."

Union officers are entitled to vigorous support from management and government in their efforts to prevent strikes. Behind many a strike is an accumulation of unsettled grievances. Managements are overworked, and many union shop stewards are new and inexperienced and do not always do their part in turning down cases which lack merit. Both of these conditions make it easy for large backlogs of unsettled grievances to pile up. A special drive to clean up unsettled cases and to prevent new accumulations of them is one way by which managements and local union officials can help shorten the war.

The government too has a contribution to make to the prevention of strikes—both through the prompt disposal of disputes and through firm action against the leaders of strikes. The National War Labor Board and the Regional Boards are disposing of over five thousand cases a month and have made an excellent record in reducing their backlogs. Nevertheless, the boards still have many old cases; and about one out of four strikes has been an effort to get action from one of the labor boards. The boards are entitled to cooperation from employers and unions in keeping down their docket. In instance after instance, cases are dumped in the lap of the board before the union and employer have made a real effort to get a meeting of minds and to work out settlements.

In the present emergency, strikes are an expression of the lack of adequate understanding and team work between unions and management. Any future great upsurge in industrial strife likewise will be due to misunderstanding. After this war this country must not go through another "1919" when the time lost from strikes reached an all-time high. With 13 million workers, or almost half of the non-salaried employees of the country, in trade unions, the power and prestige of unions is greater than ever. ***The long-run prosperity of the country requires that business and labor learn how to cooperate in supporting the policies which produce the largest possible profits and the largest possible payrolls.***

Although business is primarily interested in the largest possible profits, and labor is primarily interested in the largest possible payrolls, both objectives call for the same basic conditions. Payrolls depend upon the prospects for profits. If bad relations between business and labor or unwise public policies cause employers to take a pessimistic view of the outlook for profits, both employment and payrolls will be depressed.

Individual unions and individual employers always will have differences over wages and hours and the status of labor in particular plants or in particular occupations. Some disputes on such issues are inevitable, but resort to arbitration and calm intelligence can help greatly in avoiding strikes in the long run. Cooperation between labor and management is an economic necessity. In our kind of economy, payrolls and profits ***both depend upon the willingness and the ability of business and labor to work together in creating the conditions under which enterprise flourishes.***

The foundation for intelligent and effective cooperation must be accomplished by skillful and imaginative managers in plants throughout the country who are willing to help unions with their problems, and who are able to interest union leaders and their members in the problems of business. Union members and their leaders are keenly interested as a rule in the efforts of management to win new markets. They know that jobs depend upon the success of managements in improving the product, adding new items to the line, and, less frequently, cutting costs and prices. Employees like to be kept informed about what management is doing, what problems it is meeting, and what success it is having. Most of all, they like to have an opportunity to contribute their ideas and suggestions.

The recent epidemic of strikes should not blind us to the fact that even today there are more plants where managements and unions are on good terms than ever before in the country's history. Consider, on the one hand, the extensive and constantly growing efforts of unions to train and develop shop stewards and, on the other hand, the efforts of employers to teach foremen how to carry out the new responsibilities imposed upon them by union agreements. Unions and management together are learning how to operate together such technical devices as time study and job evaluation. Managements which, several years ago, opposed the provision of umpires to interpret union agreements and to settle deadlocked cases today are taking the lead in suggesting such arrangements.

The war is reaching a crisis, and all groups in the country must be aware as never before of their common interests. This presents an opportunity which should be seized to lay the permanent foundations for more effective team work in American industry. Let history record that the days when Europe was being liberated also were the days when unions and employers were making unprecedented progress in preparing American industry for the return of the service men by developing policies of cooperation between business and unions. Such cooperation will help achieve a peace worthy of our efforts and our sacrifices.

President, McGraw-Hill Publishing Company, Inc.

Desuperheating Increases Turbine Blade Deposits

Perhaps solids get into your turbine by way of the desuperheater. If so, says W Pack, chemical engineer for Iowa Electric Lt and Pwr Co, a simple chart tells how much

▶ TURBINE-BLADE DEPOSITS generally cause trouble in proportion to the amount of suspended solids in the steam entering the throttle. Solids in steam, however, are not always the result of faulty boiler operation; desuperheating water is a common source of additional steam contamination.

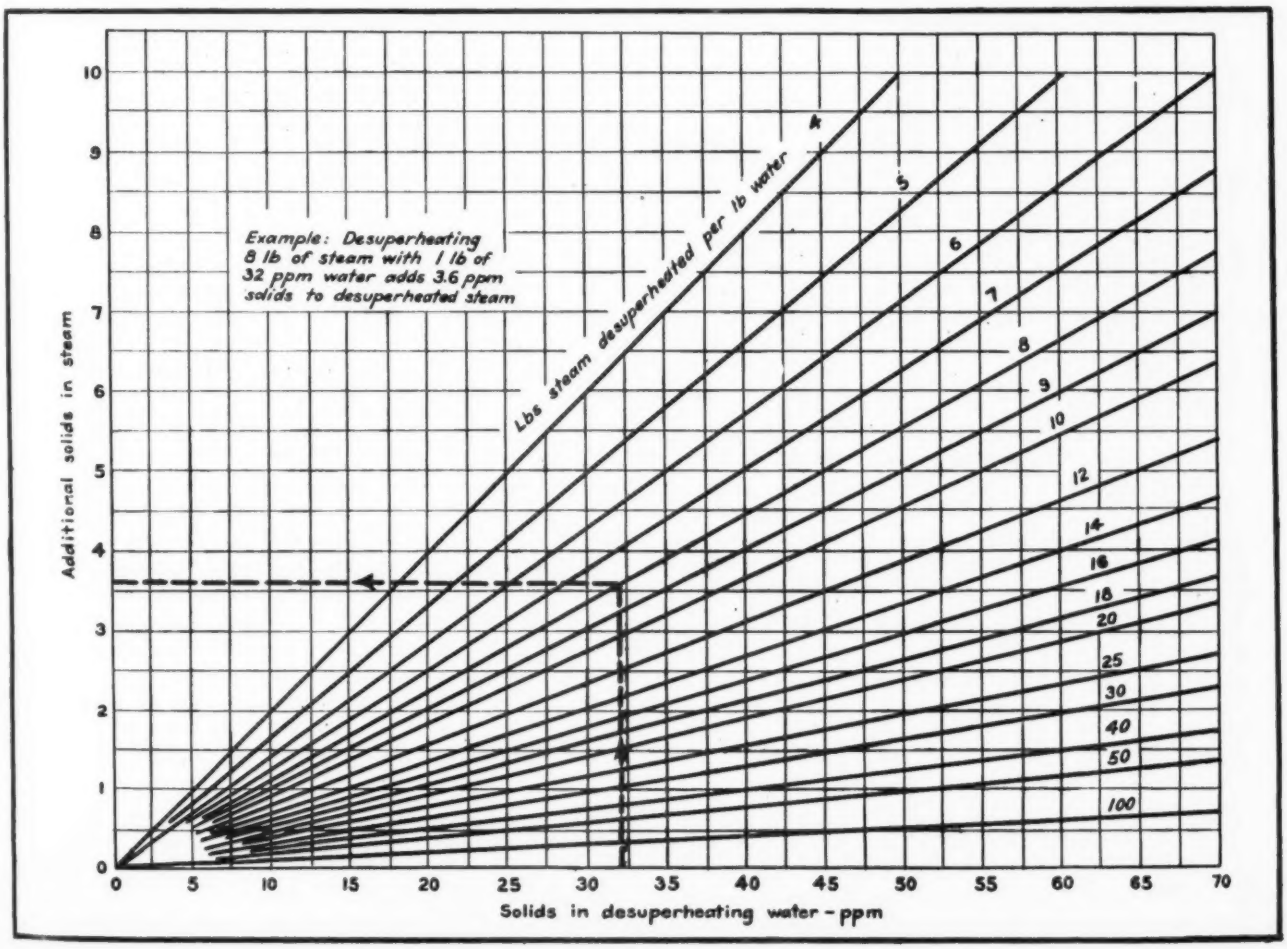
With boiler steam containing 1 ppm solids and turbine steam an additional 6.5 ppm acquired with desuperheating water, turbine fouling becomes noticeable in our turbines. Fouling is indicated by increased stage pressures and reduced efficiency. After washing off deposits, which happen to be water soluble, a change in the source of desuperheating water has stopped the fouling.

Originally, one pound of water was used to desuperheat 11.7 lb of steam to 220 psi abs, 550 F. With 82.5 ppm of solids in the desuperheating water, about 6.5 ppm per lb of steam was added from this source. Change to a water supply containing only 25 ppm reduced the added solids by desuperheating to about 2 ppm.

Chemist's report of turbine deposits showed a white, powdery accumulation containing about 6% silica, 13.8% alkali carbonates, 53.2% alkali sulphates, 13.8% alkali chlorides and a trace of P_2O_5. Undoubtedly a considerable part of this scale accumulation was derived from the desuperheating water supply. This conclusion is supported by the fact that change to water of considerably lower solids content has greatly reduced the rate of scale accumulation. Of course the chemical nature of the solids affects the amount and type of scale on turbine blades, which should also be taken into account, as well as actual quantity.

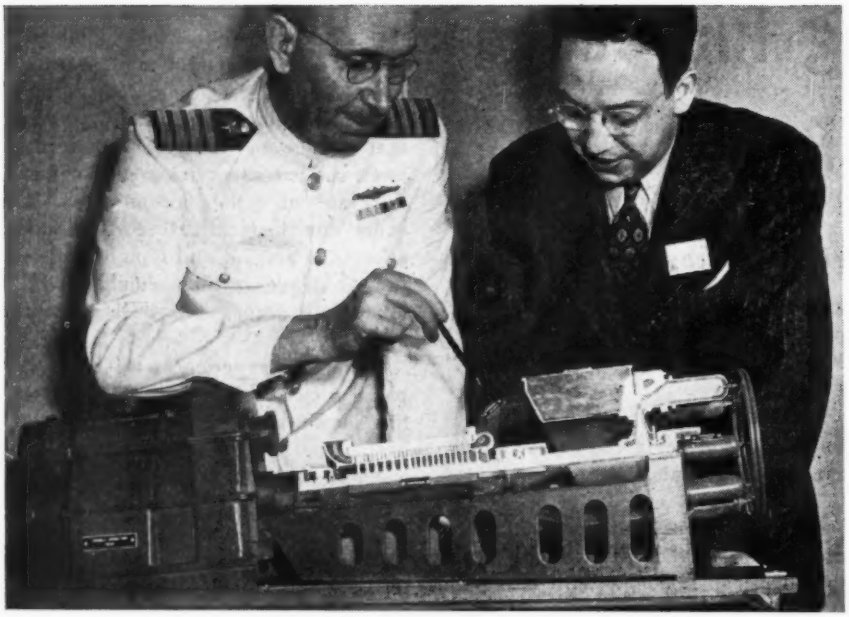
From this experience, we have prepared a chart which indicates the relation between pounds of steam desuperheated per pound of desuperheating water and the ppm of solids added. The greater the magnitude of desuperheating, that is, the greater the amount of superheat reduction necessary, the better the quality of desuperheating water needed.

For power plants that have a desuperheating water supply that does not vary in dissolved solids content one calculation may be enough. Where feedwater is used and solids fluctuate with the amount of makeup, the chart on this page shows at a glance the ppm of added solids to expect when quality of desuperheating water is known.



What's Ahead

Turbocharging developments, gas-turbine prospects, improvements in plant de-



Captain Lisle F Small, Bureau of Ships, U. S. Navy, and J Kenneth Salisbury, General Elec Co, examine model of 3000-hp GE gas turbine as proposed for ship drive

▶ DEALING WITH both current problems and future prospects, the 17th National Oil and Gas Power Conference, held at the Mayo Hotel, Tulsa, May 8-10, drew a record attendance of more than 350 diesel and gas engine men. Technical sessions covered supercharging and gas turbines, power plants, engine controls and governing.

Citing the rapid growth in turbocharging of 4-cycle engines, C F Harms, manager, supercharger dept, Elliott Co, outlined the considerations involved in applying this form of supercharging to both existing engines and new designs. Discussing the importance of proper exhaust manifolding, Mr Harms pointed out that reducing size of exhaust pipes to the turbocharger, increasing their number and straightening and properly streamlining them, permits transmitting additional energy to the blades of the exhaust-gas turbine and results in better performance. For example, four inlets in place of two on an 8-cylinder engine produces markedly improved results, and eliminating a right-angle bend in the exhaust line to the turbine on a high-speed engine reduced preturbine temperature approximately 75 F. Engines with uncooled insulated exhaust manifolds show better turbocharger performance than those with cooled manifolds. This has led several companies to develop water-blanketed manifold designs which reduce radiation from the exterior surface but do not remove any appreciable amount of heat from the exhaust to the turbine. On the other hand, watercooling often brings advantages in cost, operation and maintenance that outweigh the disadvantages.

Extensive tests to eliminate the penetrating high-pitched noise associated with early turbocharger designs led to use of a redesigned diffuser, together with an improved intake silencer, and it was found that shape and material of the intake manifold materially influenced the noise; sound-deadening treatment is recommended for thin sheet-steel manifolds. Mr Harms concluded by emphasizing the present trend to higher specific outputs, citing tests on units operating up to 150 psi bmep, with the end not yet in sight.

Gas Turbines

At the same session, S A Tucker, Associate Editor of POWER, presented a paper "Gas Turbines—Present Status and Future Prospects." Dealing primarily with the continuous-combustion cycle, he outlined briefly the principle of operation and the recent developments in this country and abroad. Clear thinking on the prospects of this new prime mover depends, he emphasized, on separating what can be done with existing designs and materials from what may be done with new constructions and improved metals. Without going beyond limits proved by experience, gas turbines can find a definite place in road locomotives, marine drives, blast-furnace blowing plants, and certain parts of the power-generation field. In all but the blast-blowing applications, the present gas turbines show somewhat lower efficiency than the best competing equipment, but advantages in simplicity, compactness, weight and first cost bulk large enough to make them worthy of consideration. Tests of gas-turbine blowing sets indicate better over-all performance than equivalent steam plant with boiler and condensing turbine-driven compressor.

In all these cases, no obvious "ifs" are apparent. Designs comparable to those already developed require no great advance in metallurgy, and heat exchangers proposed are neither of excessive size nor greatly different from those with which steam operators are already familiar. Fuel and combustion problems with oil or gas, while not worked out in a variety of detail, appear to offer no serious obstacles to immediate developments.

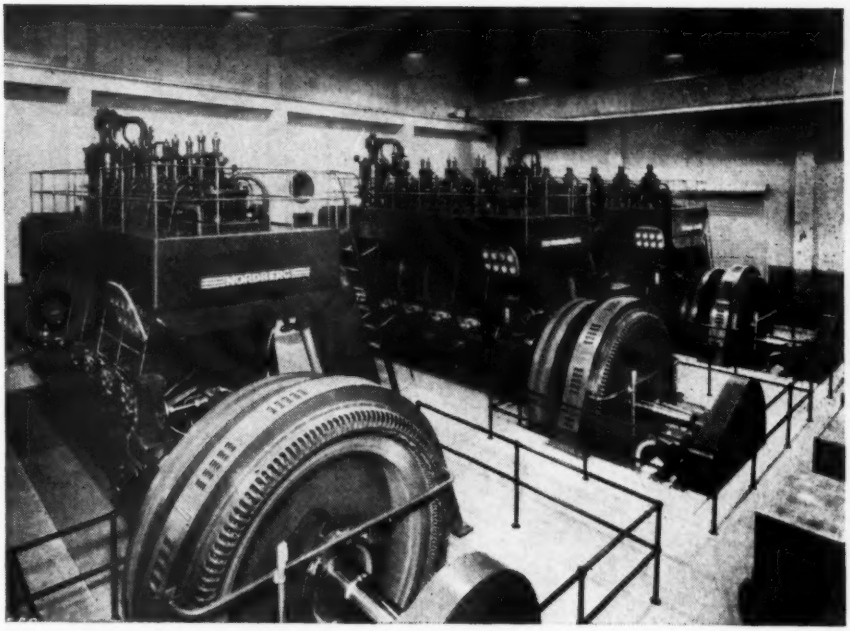
Commercially, the applications described represent competition with only a small fraction of either diesel or steam turbine fields. Sizes proposed—2000 to 10,000 kw—overlap only with larger diesels and smaller turbines and compared with the steam turbine, the gas turbine is restricted, for the visible future, to areas where oil or gas is the normal fuel.

However, if one or another hope becomes fact, Mr Tucker said, potential ability of the gas turbine to compete outside these limited fields fires the imagination. If temperature at which blades can operate can be raised several hundred degrees by advances in metallurgy already in prospect, if some satisfactory method of handling coal as fuel is developed, and if larger power outputs are obtained, then the gas turbine can become a most important factor in the transportation and power fields. With forced-circulation heating surface surrounding the combustion chamber, it becomes an important means of supplying process steam as well as compressed air.

These "ifs" present tough problems for research staffs, and only the first halting steps toward overcoming them have been made. Brown Boveri and Allis-Chalmers have given serious attention to coal firing, but there is as yet no indication of success or failure. Gen-

for Diesels?

sign and operation, engine controls and governing spotlighted at ASME meeting



Three 2000-hp gas diesels in plant of Universal Atlas Cement Co, typical of units discussed by R J Cramer in "Progress in Gas-Burning Diesel Engines and Plants"

eral Electric and Westinghouse. leaders in high-temperature metals research, both exhibit caution as to the prospects. Escher Wyss of Switzerland and Westinghouse have proposed closed-cycle designs for large outputs but these arrangements require removal of heat at the lower level, in the same manner that a condenser serves the steam cycle, and other complications.

Summing up, Mr Tucker pointed out the need for keeping discussion centered on the more or less immediate applications which are real, known, and can be evaluated by commonly accepted economic factors, or else admitting that speculation depends on the metallurgist, the application engineer and the inventor. Barring a major miscalculation on the part of practically every manufacturer who has investigated the matter, ship and locomotive drive, blast-air units, chemical-process superchargers and small power units are now practical and economically attractive. Large power units to burn coal, efficiencies higher than those of diesel engines, and commercial application to aircraft must come from painstaking work in research laboratories.

Marine Propulsion

A second paper on gas turbines "The Basic Gas-Turbine Cycle and Some of Its Variants," presented by J Kenneth Salisbury, General Elec Co, is given in abstract on page 91 of this issue.

Speaking at the banquet, Captain Lisle F Small, Bureau of Ships, U. S. Navy, outlined the growth of diesel drive in Navy vessels, citing the vast strides made during the war years to the point where total diesel horsepower in the fleet now exceeds steam horsepower. Looking to the future, he traced the path of probable future development in the direction of higher specific output and indicated a strong belief that out of the development of highly supercharged engines would come a new power unit combining the reciprocating and turbine principles. He visualized the ultimate development of such a power plant as a free-piston diesel compressor supplying exhaust gas under pressure to a gas turbine generating all the useful power of the combination. (See POWER, Dec, 1942, p 102).

Development of the gas-burning diesel has been carried forward in three stages, according to R J Cramer, asst chief engr, Nordberg Mfg Co, who spoke at the session on power plants. The first stage, shop experiments on a 3-cylinder engine, dates back to 1928. It established the fact that gas would ignite and burn in a diesel cylinder without other ignition, although injection of pilot oil improved combustion. In the second stage, a 5-cylinder engine was converted in the field and tests showed that natural gas as well as city gas could be handled and that governing by needle-valve lift was feasible. The third stage, development of hydraulic valve gear, resulted from installation of the first gas-burning diesel at the municipal plant in Lubbock, Texas. (See POWER, Sept, 1937, p 515.) This hydraulic system for lifting the fuel needle valve, without modification, has been used on all gas-burning diesels since and on air-injection engines as well.

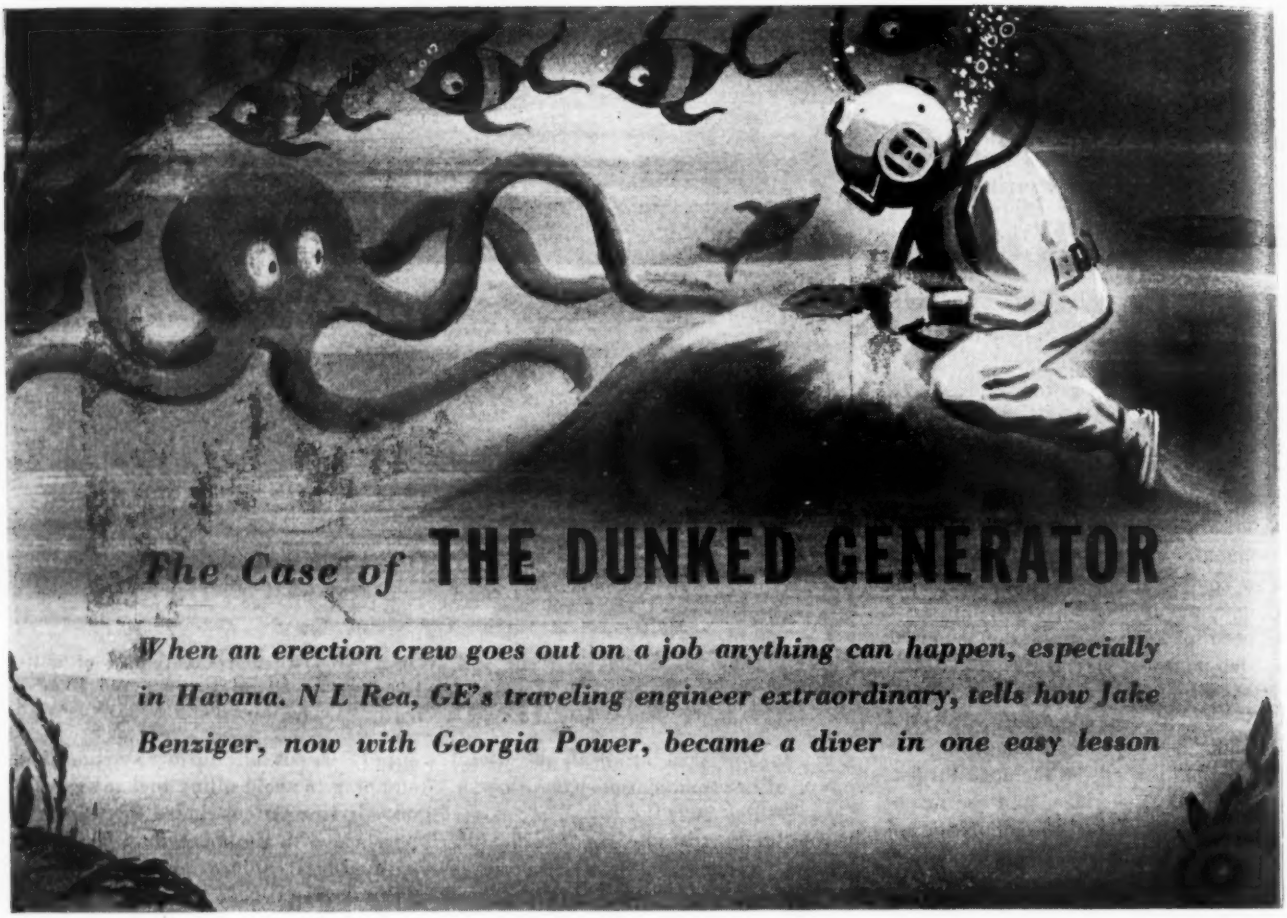
Use of pilot oil, representing approximately 5% of the total heat supplied to the engine, overcomes erratic ignition encountered when gas alone is burned. Pilot oil was originally supplied by conventional multiple fuel-injection pumps but in more recent installations it has been found desirable to use small individual fuel-injection pumps, permitting convenient adjustment of pilot oil to each cylinder. Amount of pilot oil remains constant at all loads but oil supply is cut off during starting and stopping to avoid filling fuel valves with oil. Mr Cramer concluded by citing experience with the more than 90,000 hp of dual-fuel engines now operating on natural gas.

At the same session, Ralph L Leadbetter, director of engrg and development, Burgess-Manning Co, discussed "Exhaust and Intake Systems for Best Performance and Quiet Operation." Of all the accessories and auxiliary equipment that go with a diesel engine, probably none is more responsible for unaccountable engine behavior than are the air-intake and exhaust systems, he said. Describing a device for measuring intake or exhaust pressure at any predetermined point of crank angle, he presented a series of charts showing the effect of intake and exhaust pipe length and snubber location. For intake systems, these showed that there is usually an optimum pipe length, and that where plant conditions cause undesirable pipe-length effects, proper snubber location can counteract such effects.

He pointed out that the standing pattern on the exhaust pipe of a 2-cycle engine has an important effect on performance and that snubber location can be used to offset the standing pattern just as was discussed for intakes. With pump- or blower-scavenged engines the standing pattern is of minor importance compared to the effect of standing pattern on crankcase scavenged engines.

Of major importance to pipeline operators was the paper "Operation and

(*Continued on page* 146)



The Case of THE DUNKED GENERATOR

When an erection crew goes out on a job anything can happen, especially in Havana. N L Rea, GE's traveling engineer extraordinary, tells how Jake Benziger, now with Georgia Power, became a diver in one easy lesson

► ONCE UPON A TIME a gang of erectors went to Havana to install a vertical turbine-generator. All went well until the stator was brought alongside the dock. The lighter's deck stood several feet below dock level so they made fast a couple of ropes to hold it while they raised the stator skid to deck level with jacks and cribbing. Eventually they got the skid high enough to place some long timbers extending from the dock to the cribbing. A cable was brought out through snatch blocks so the powerhouse crane could pull the skid ashore on rollers.

None of the men had any sea experience so no one paid much attention to the lighter. As the stator moved nearer the dock, the lighter tipped down and threw a direct strain on the mooring lines. The lines parted and the lighter shot out from under like an apple seed from between a small boy's thumb and finger. The timber ends dropped down and the round stator rolled out of the skid. They had a good hold on the skid and managed to save it, but no one had thought to secure the stator in the skid, a most unfortunate omission.

A diver was finally located who reported there was a big dimple in the harbor silt, but no stator. With 20 ft of water and 30 ft of silt, it took two days of pumping to get enough silt out of the way to expose the stator. By this time it was Saturday night and the diver insisted on collecting his $35 per for three days. Yes, he would be back Sunday morning. "On my honor!"

Sunday morning: no diver. A searching party found enough of his trail in the grog shops to know he wouldn't be worth finding. But the stator had to be salvaged as soon as possible and that meant only one thing. One by one the men tried on the diving suit. It turned out that the only one who could stand the pressure was Jacob U Benziger, now superintendent of Georgia Power Co's Plant Atkinson. Thus elected unanimously for the job, Jake had his first and last experience as a diver.

The gang rented a pair of squared timbers 18x18 in. and 40 ft long, and rigged them as parallel levers over a fulcrum on the edge of the wharf, with about 15 ft projecting over the stator's watery berth. With the inshore end of one timber raised, the diver secured a cable from the short end to the stator. A cable run through snatch blocks from the powerhouse crane pulled down the timber's long end. Then the hitch was shifted and the other lever raised.

In this way the gang seesawed the stator high enough to shove the lighter and skid under it. Then the jacking and cribbing was repeated until the stator could be rolled off onto the dock. This time they made sure the lighter was tied to the dock so it couldn't skid out from under.

The real diver sobered off enough by Wednesday to come around to finish the job. By that time the stator was safely inside the powerhouse. Indignant, the diver began a long harangue about rental and wages for the days his equipment had been used.

"Nonsense," he was told. "How do you know your equipment was used? You're the only diver for miles around. Who else could have used it?"

Realizing that to answer might dent his professional pride, the diver decided to retreat from his obviously weak position and started away mumbling. "And you know," says Jake, "he *is* the only diver for miles around. Whatever kind of underwater gymnastics you talked me into Sunday certainly wasn't diving and, what's more, no one will ever talk me into it again!"

THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS — ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Get the Jump on Furnace Failures With Early Repairs

Every engineer has pet ways of doing routine jobs that come up with clockwork regularity. Here's how S M Elonka keeps boilers shipshape and wards off shutdowns

SHORTAGES OF MATERIALS and experienced help, plus greater power-output demands, tax the operating engineer's ingenuity in making boiler and refractory repairs. In the short outage time available, he must often take the chance that patching bad spots, instead of rebuilding furnace walls, will see him through an emergency period. To cut down outage time on 3-pass sectional-header oil-fired boilers, Fig. 1, I have worked out the following schemes.

Removing soot. After cleaning the fire side of tubes and repairing baffles I scrape the soot from furnace-roof baffle, Fig. 2, by removing the two center tiles nearest the front header. Working through side portholes makes it easy to dump the soot down into the furnace instead of pulling it out the side to scatter throughout the fire room.

Baffle repairs. After removing the dumped soot from the furnace examine roof tile and bottom tubes. Wire-brush the tubes to remove scale and soot, Fig. 3-A. This exposes any indication of tube blistering. Next, to make a true estimate of the roof condition, remove loosened or burned pieces by wire-brushing the tile, taking care not to disturb it by excessive pressure.

If a section is burned thin, Fig. 3-D, patch it with a 50-50 mixture of fire clay and loose asbestos. Warped tiles can be remedied by filling the opening between them and the tube, Fig. 3-C.

Since roof tile acts only as a baffle, an air-tight patch is as efficient as a new tile for the new material bakes to the eroded surface. By patching the tile in three boilers I have made two dozen roof tiles of assorted sizes last one year where previously this number lasted only one month. Replace tiles that cannot be patched, Fig. 3-B.

Side walls. The central side-wall area in some oil-fired boilers erodes thin, especially when large tips are used for heavy firing. Some engineers tear out thin walls and rebuild them completely. Although good practice, this is not necessary, because a serviceable wall can be had by patching, Fig. 4.

To do the job successfully, remove a few bricks at a time from the burned

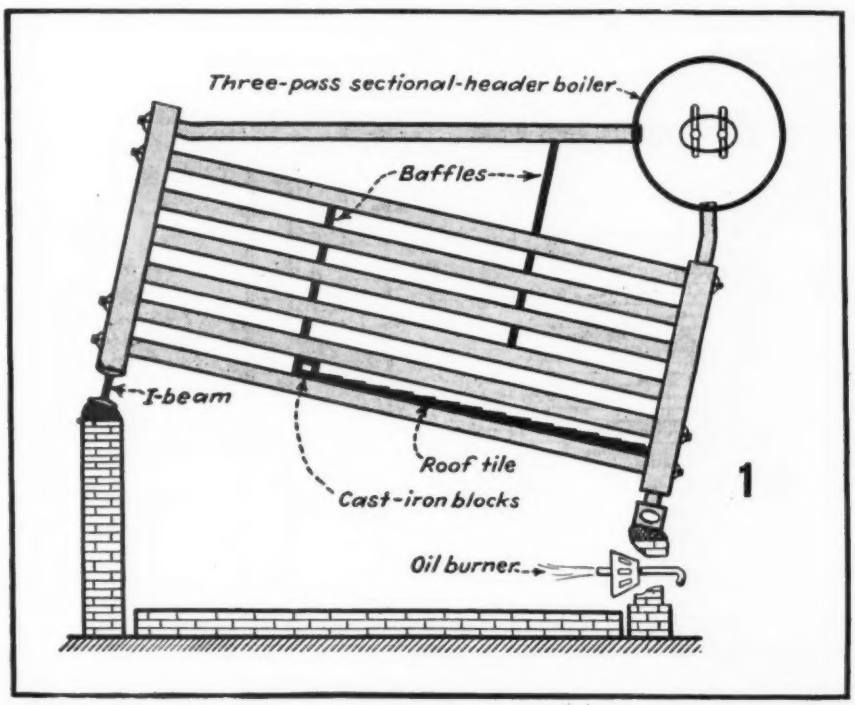


Fig. 1—Keep up performance by repairing baffles and roof tile before gas path is short circuited. Remove slag from furnace floor on every convenient outage

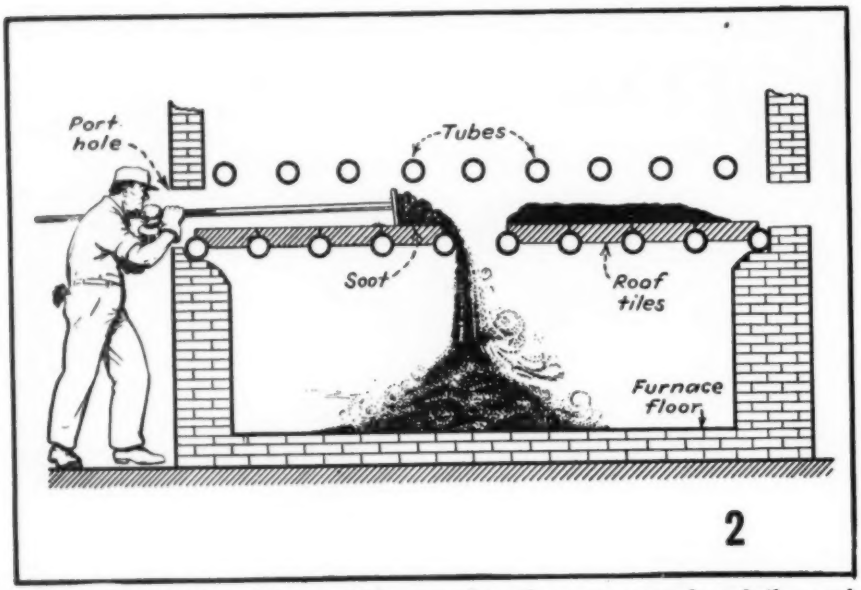


Fig. 2—After baffles and upper tubes are cleaned remove several roof tiles, and scrape accumulated soot to the furnace floor instead of out the portholes

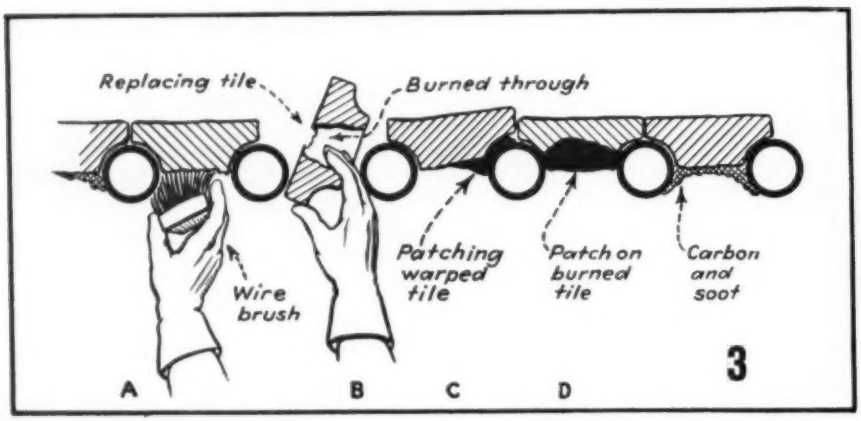


Fig. 3—Wirebrush tubes and roof tile to expose blistering or eroded areas. Patch thinned tiles and replace those that are burned through and worthless

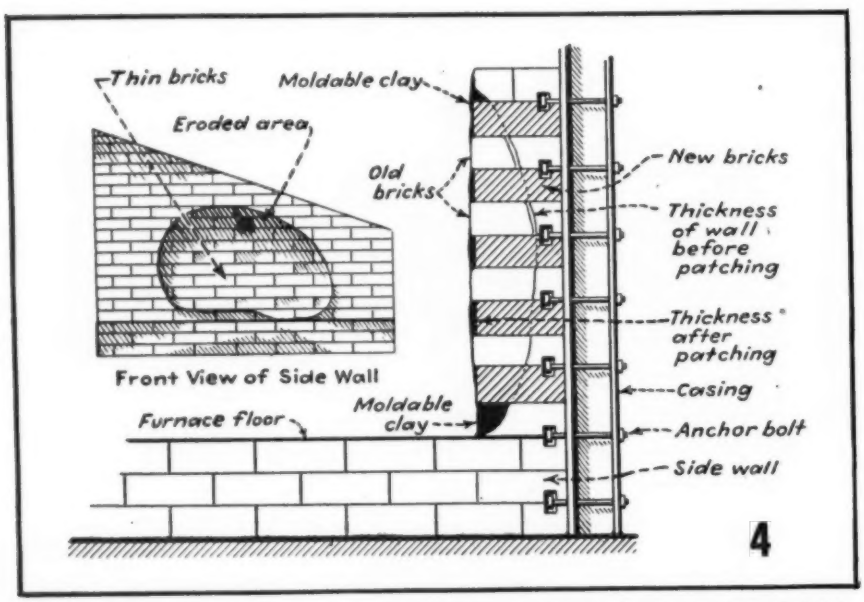


Fig. 4—Side walls that have been eroded thin are built back to original thickness with plastic and brick. Use old brick for filling between rows of new

area and replace with new bricks and half bricks (used), thus: Remove about four thin bricks near the floor. Replace the lower brick with a new one, lay two old half bricks on top of it and place another new one on top of the two halves. If you take care in selecting the two used bricks for length, little chipping is necessary to make them equal one brick in length. Put rough ends inside and, for binding, dip the bricks in a thin fire-clay solution before inserting them. Coat the newly patched wall with a thin solution of water and fire clay, and fill the area at the rough ends with moldable clay.

Rear wall. When examining the rear wall be sure to inspect the I-beam supporting the back headers, Fig. 5; it must be completely covered with clay as a protection against burning, because it is in the hottest part of the furnace. After removing soot, hammer plastic clay between top of wall and headers, filling even the narrowest space between the old plastic clay and headers.

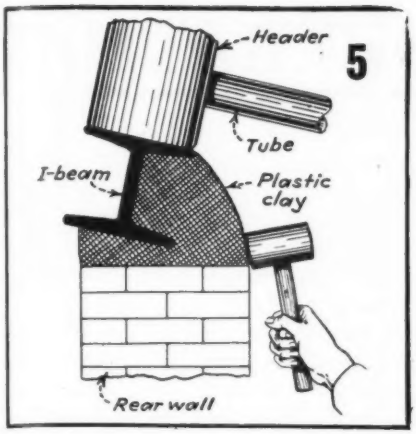
Slag Chokes Furnace

Furnace floor. Fig. 6-b indicates how built-up slag decreases the furnace volume in oil-fired furnaces. This condition causes oil impingment which increases carbon formation and results in smoking. Remove slag to *a*, by cracking it with a pickax or pointed bar, exercising care not to damage brickwork.

Moldable clay. A quick repair job can be made with plastic, or moldable clay. However, as many furnace walls are spoiled by this method as are repaired. Before using plastic clay, I find it good practice to chip off the glaze from the area to be patched. Then I thoroughly hammer the clay into the wall with a small wooden mallet, making sure to fill all cracks. Fig. 7 shows how to prepare a patch. Pierce tiny holes, about one-eighth inch in diameter, every two inches or so apart. They help to dry the patch thoroughly by allowing the moisture to escape.

Always dry out newly patched or rebuilt walls as slowly and thoroughly as possible. If time permits, slightly opening the air dampers does the trick. A slow-burning wood fire dries walls out in less time if the boiler must be returned to service in short time. Most important thing to remember about brickwork is that maximum service can be expected only if it is repaired at regular intervals.

Cleaning the boiler internally. Cleaning at regular intervals is imperative,



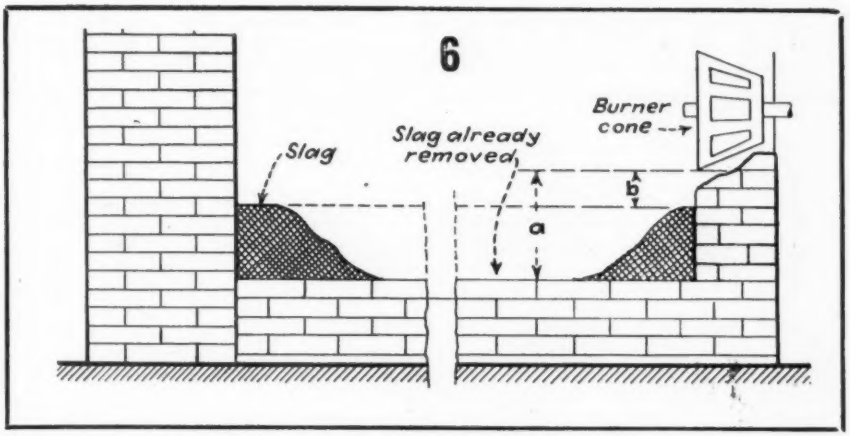


Fig. 5—Protect supporting structure and cold parts from furnace heat

Fig. 6—When slag builds up on the furnace floor it reduces the volume needed for complete combustion and chokes off air flow through inlets in the floor

especially if the feedwater contains sediment or scale-forming impurities. Before sending a man into the boiler, lash shut all steam valves and bottom blowoff valves to prevent accidental opening and serious injury to workmen inside the boiler. Another precaution is to post a man outside the drum.

Before entering the steam drum, wash it with a strong jet of water to remove loose sediment and cool the metal. This also washes the front sectional headers as the water drains through the downcomer nipples.

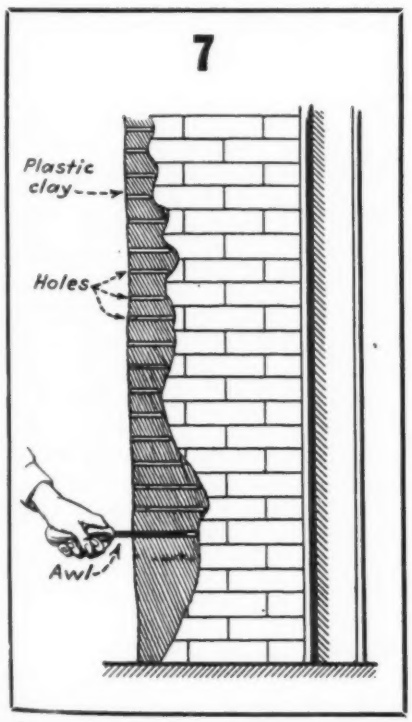
To wash back headers, insert the hose into each circulating tube, Fig. 8, and wash each one until water flowing at the mud-drum opening is clean. Be particularly meticulous when wire-brushing and washing the bottom rows of tubes, because tube for tube they evaporate more water than those out of sight of radiant heat. Bits of scale or impurities settling here cause quick blistering and failure, which means an unnecessary service loss as the least damage.

Water Instead of Oil

It is not necessary to mix cylinder oil with graphite to make handhole gasket dope. Water-mixed powdered graphite adheres to gaskets just as well, if they are soaked in water a few hours. ("Practical Aids," June POWER.)

Hydrostatic test. Never place a boiler in service after inspection or overhauling without giving it a hydrostatic test to ascertain if it is free of leaks. This takes only a few minutes. Fill with water until it flows out the air vents on steam drum. Then close the vent and crack the main feed-line valve so that the feed pump supplying the other boilers maintains full pressure on the boiler under test. Then examine the fire side and tube-header caps for leaks. If any are found, empty the boiler and make necessary repairs.

Systematic overhauls assure maximum service from each boiler and greatly lighten the engineer's work by preventing unnecessary shutdowns.



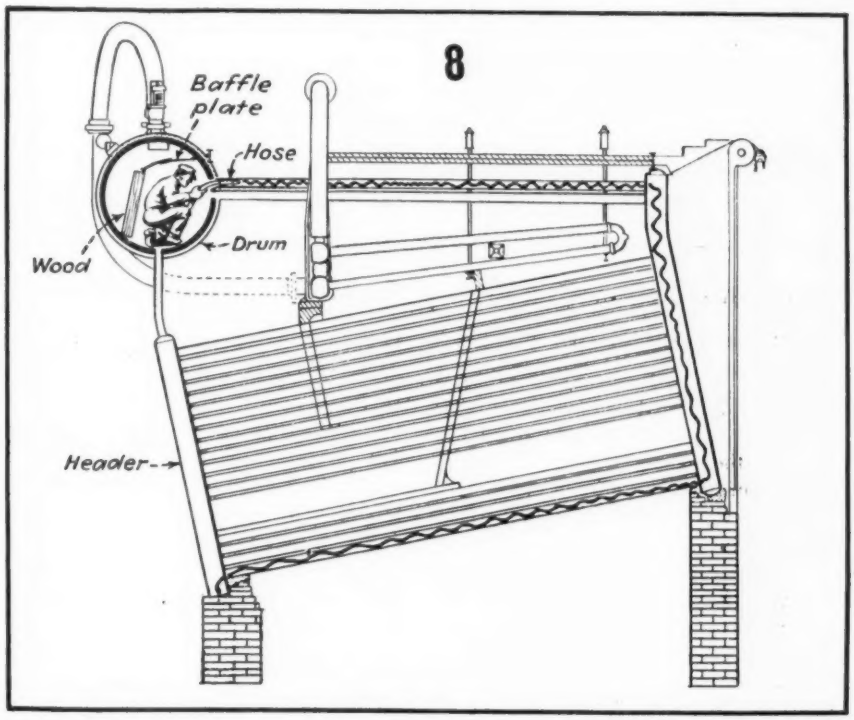


Fig. 7—Punch holes in wet plastic to allow moisture escape during drying

Fig. 8—Wash out drum and front headers; then clean rear headers by flushing through circulating tubes. Wash steaming tubes through hand-holes

PRACTICAL AIDS TO OPERATION

Truck's Stake Hole Supports Pipe Vise

WHERE A LOT OF REPAIR WORK was done from a truck one of its stake holes supported a pipe vise. As the photo shows, the vise bolts to one end of a piece of $\frac{3}{8}$-in. steel plate approximately 12 in. long. To the other end, but on its bottom side, is welded a 4-sided, tapered, hollow steel plug, about 4 in. long, that fits snugly into any one of the truck's stake holes. An accurately built plug has little or no movement in the stake hole. The plug vise wedges down into it and remains tight until removed by a sharp rap from a hammer from below.

Since the vise and mounting is small and easily removed, it is kept in the tool box between jobs. When the vise is needed, it is but a minute's work to insert the plug into any convenient stake hole near the work being done. The small cost of building the holder will be repaid many times in time saving on the job.

Pomona, Calif. G M WILSON

Traveling-Grate Stoker Maintenance Hints

WEAR ON TRAVELING-GRATE STOKERS is generally high but now that repair parts are almost impossible to get a little care will lengthen their lives and prevent costly shutdowns.

First, make sure that oil and grease for stoker lubrication are of proper quality and applied as the manufacturer recommends. Pressures on gears and bearings are high so to prevent excessive wear, lubricate them according to a reliable lubrication engineer's recommendations.

Properly bank the stoker. Run all coal out of the hopper, leaving a narrow space between the grate and coal. This space lets air pass under the grate to keep it cool. Let forced- and induced-draft fans run until the furnace has cooled. Then stop the fans and close the dampers to restrict air flow through the furnace. Open the outside stoker compartment doors letting outside air flow in under the stoker to cool it.

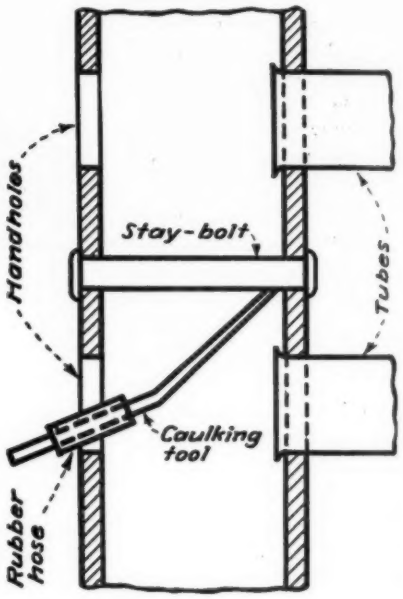
When putting the stoker back into service cool it by running the fans a few minutes before starting, as it may be hotter than it would be in operation.

Ten or twelve courses of slag-resisting brick in the furnace walls just above the stoker line assist in keeping slag off the walls.

Check the amount of slack in the clips across the grate. When they become tight remove a clip from each bar, as clips grow because of heating. Check stoker slack and if excessive take it up with wedges behind the bearings or by whatever means provided.

After each shutdown carefully check the stoker. Look for worn or bent parts, check places where the moving stoker can rub on stationary parts. When any condition is abnormal correct it at once. The old saying, "An ounce of prevention is worth a pound of cure," holds doubly true when applied to a stoker.

Tacoma, Wash. K M WHITE



Special Tool Caulks Water-leg Staybolts

RECENTLY A box-header watertube boiler became overheated, which not only damaged the tubes but loosened staybolts supporting the water-leg sheets. At first, it appeared that the only way to reach the staybolt ends on the fire side was to remove the tubes. Some leaking bolts were so high in the water leg that they could not be reached from below and were also inaccessible from under the drum.

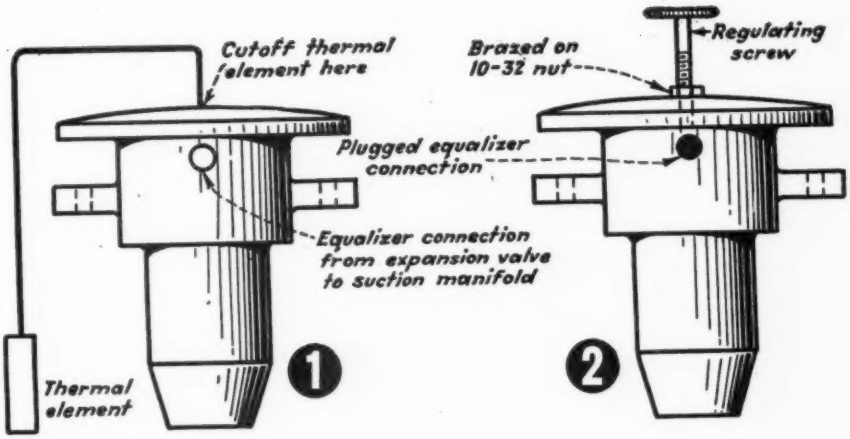
If the tubes were removed and the staybolts caulked a hydrostatic test could not be made on the staybolts by filling the boiler with water until the tubes were installed. If this were done and the staybolts leaked, it would be necessary to again remove the tube to work on the bolts. Finally we decided to

make a special caulking iron like the one in the diagram that could be used through the outside handhole openings to caulk the plate of the waterleg around the leaking bolts. When this was done, the leaks stopped.

Kansas City, Mo. D E GRIM

Changes Automatic Valve For Manual Operation

WHEN MAKING PREPARATIONS to operate the air-conditioning unit in one plant I found the evaporator expansion valve would not operate because its thermostatic element had been over-expanded. We were promised early delivery on a new valve, but warm weather came along without much assurance as to when it would arrive. We then decided to change the automatic valve to operate manually.



The old valve was closed by a spring and opened by pressure in the thermal element on a diaphragm. Fig. 1 shows a simplified diagram of this valve. To change it to manual operation we cut off the thermal element tube close to the valve top and drill-tapped its hole in the valve top for a 10-32 screw. To reinforce the tapped hole we screwed a 10-32 screw with a nut on it into this hole, ran the nut down and brazed it to the cover, Fig. 2. We plugged the equalizer connection hole in the valve. Then with a 10-32 screw in the tapped hole we could position the valve to any desired opening. The manually positioned valve was so satisfactory that we continued to operate with it even after the automatic valve arrived.

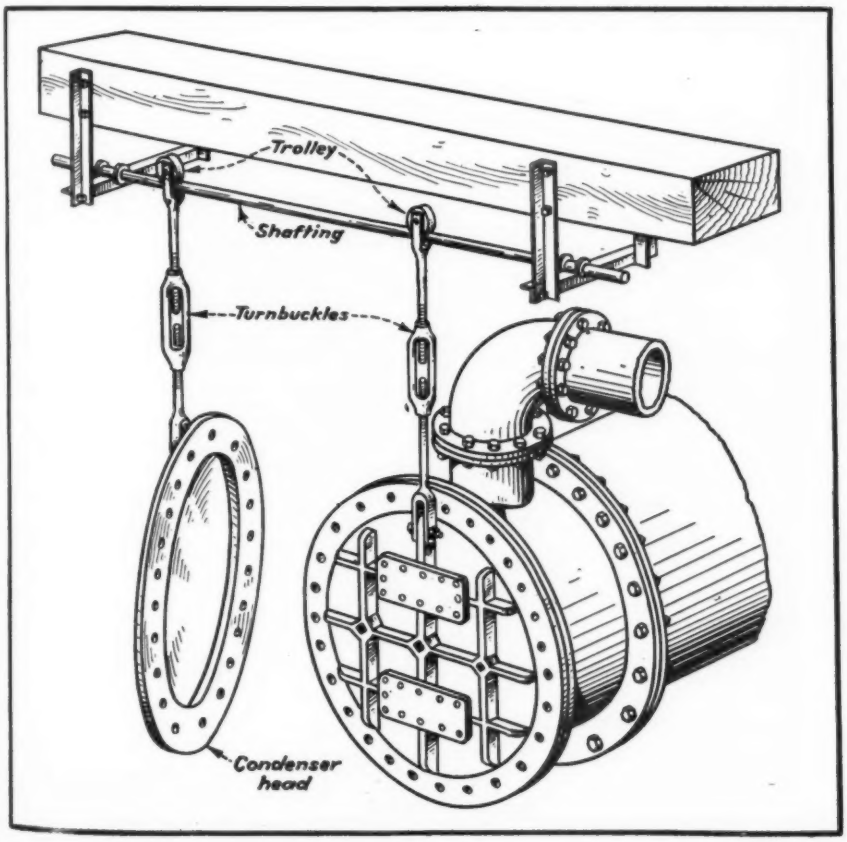
Detroit, Mich. CARL BACHMAN

Turnbuckle Eases Condenser Head Removal

THE DIAGRAM SHOWS a trolley and turnbuckle hook arrangement that removes and replaces condenser heads. It is made of a few pieces of angle iron, a length of shafting and a turnbuckle attached to a small sheave that serves as a trolley. Two collars on the shafting at each angle-iron support prevent the shafting from moving endwise.

To remove a condenser head we first connect the turnbuckle and tighten up on it until the trolley takes the weight of the head. After this we can easily remove the bolts without any attention to supporting the head. Then the head is easily moved forward, rolled to one side on the trolley, given a quarter turn and placed out of the way alongside the condenser. To replace the head, operations are reversed.

Prescott, Ore. F A FURER



Engine and Compressor Cylinders Need Clean Air

DIESEL ENGINES use large quantities of air in their cylinders that come into contact with rubbing surfaces of pistons, rings, liners, valves and valve seats. It is, therefore, imperative that this air be clean and free of dust particles. This is also true of air compressors.

Test shows that air in industrial districts averages two or more grains of dust per 1000 cu ft. On construction jobs the dust content runs much higher than in industrial districts. There are 7000 grains in a pound. A 500-cfm air compressor, operating 8 hr per day will in one month handle 7,200,000 cfm of air. In this air there will be at least 2 lb of dirt and frequently much more, with all its abrasive and other injurious effects. Similar calculations apply to diesel engines.

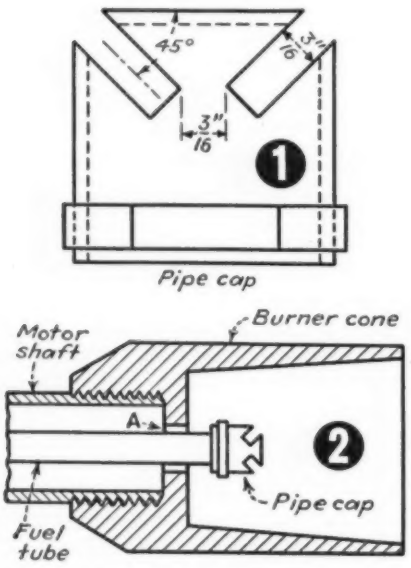
Installation of efficient air filters on air-intake pipes of air compressors and diesel engines removes a large part of the dirt from the air and greatly reduces valve grinding, cylinder reboring or

sleeve replacement, piston-ring renewals, shutdowns; it aids in maintaining the original capacity and efficiency of engine or compressor. Clean air also reduces lubricating-oil consumption and increases engine and compressor life.

Because of the character of dirt in air, select air filter for diesel engines and compressors carefully. Surveys made in many cities show that air-borne dusts have a particle size of only 1 to 3 microns (1 micron = 0.00004 in.). Microscopic dust is the most objectionable because generally it is the most abrasive. Such dust floats in the air and is present even in still air.

Because of the large quantity involved and its relation to operation of air compressors and diesel engines, air cleanliness should be given equal consideration with lubrication, cooling water, bearing adjustments and other factors. Frequently, however, little attention is given to the air supply with resulting increases in maintenance costs and loss of efficiency and reliability. Air cleanliness should be foremost in the minds of diesel-engine and air-compressor engineers and air filters installed on all these machines and maintained according to manufacturers' instructions.

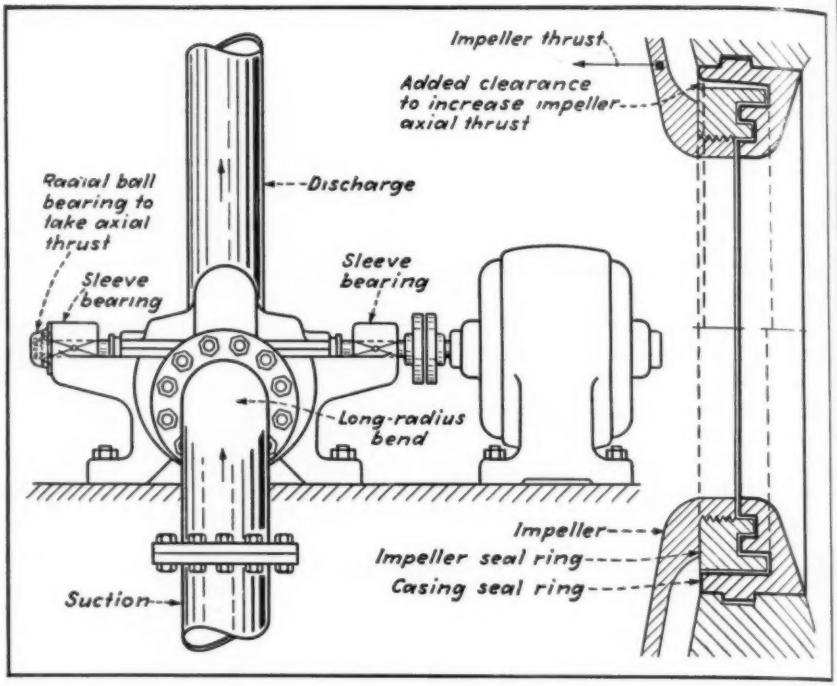
Long Beach, Calif. A R CIOTTI



Pipe Cap Used for Tar Burner Tip

WHEN USING the tar byproduct of gas as boiler fuel, I encountered several difficulties. Tar would carbonize and plug the burner tip, creep back on the cone and harden between fuel tube and motor shaft at *A*, Fig. 2, and get back into the fan throwing it out of balance. Tar at *A* dried and hardened so rapidly it was necessary to remove the burner tip about twice a day, and several fuel tubes had to be replaced every week. To correct the trouble I tried several different homemade burner tips and finally developed the one in Fig. 1. The tip has worked satisfactorily, and may help to solve burner problems elsewhere.

It is made of a 3/8-in. pipe cap and a section cut from a meter-swivel nut. I cut two 1/8 in. slots in the pipe cap on a 45-deg. angle, Fig. 1. These slots force the fuel farther out on the burner cone. Fig. 2, and it tends to go on out instead of creeping back to the base of the cone. A hexagonal nut brazed to the cap keeps tar from creeping back on the fuel tube and also permits using a socket wrench to install and remove the burner tip. This tip burns tar or fuel oil equally well, does not plug up, and produces a good, even fire. I believe



Loading Improves Bearing Operation

FIG. 1 DIAGRAMS one of our two large single-stage double-suction 3600-rpm centrifugal pumps. Impeller of each pump runs in sleeve bearings and has a radial ball thrust bearing on its outboard bearing, as indicated. After several months of satisfactory service the thrust bearing on one of these pumps became noisy with an increase in temperature. This indicated that unless the trouble was corrected the thrust bearing might fail prematurely and cause a shutdown of the pump.

Inspection of the thrust bearing and pump impeller showed nothing wrong. The impeller apparently ran centered in the pump casing, with no noticeable wear on the seal rings. Evidently, any slight wear or other changes within the pump were in a direction to bring the impeller in axial hydraulic balance when the pump was running.

I have found that ball thrust bearings may run hot and noisy when operating unloaded at high speed. I decided, therefore, that to correct the trouble load on the thrust bearing should be increased. This I did by increasing the axial thrust of the impeller in the direction of the bearing.

To do this I chucked in a lathe the casing seal ring from the inboard side of the pump and bored it to increase the clearance, Fig. 2. Increased leakage through this seal ring increased the pressure in the labyrinth seal to push the impeller toward the thrust bearing and keep it sufficiently loaded.

When the pump was reassembled and put back into service its thrust bearing operated satisfactorily and has ever since. Normally it is assumed that conditions in a pump are ideal when the impeller operates in axial hydraulic balance. Here, the thrust bearing required some load for best operation, as our experience proved.

Philadelphia, Pa. EMIL WHITMAN

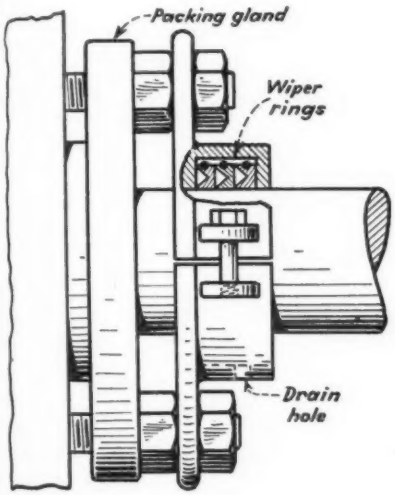
that by changing the width of slots, the same general design can be adapted to almost any fuel burner.

Marysville, Calif. RAYMOND HEYL
Pacific Gas and Electric Co

What Size Wrench?

TO FIND THE SIZE of wrench to use on hexagonal nuts, multiply the diameter of the bolt by $1\frac{1}{2}$ and add $\frac{1}{8}$ to the answer. For example, size of wrench for a $\frac{3}{4}$-in. bolt is $\frac{3}{4} \times 1\frac{1}{2} = 9/8$. Add to this $\frac{1}{8}$ and we get 10/8, or $1\frac{1}{4}$ in. This is the size socket, box or open-end wrench to use.

Salishan, Wash. K M WHITE



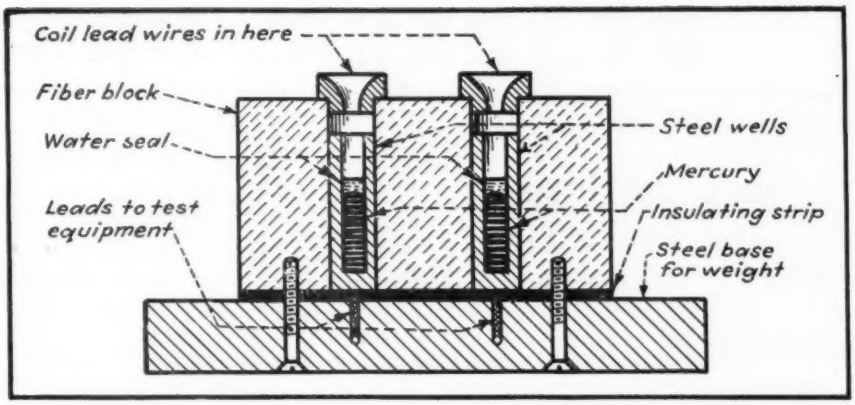
Wiper Rings Keep Water Out of Crankcase

WHEN A BADLY WORN PISTON ROD of a steam engine began to carry water through equally worn packing into the crankcase, we made three brass wiper rings having a cross-section like that in the diagram. We cut each ring in half so that it could be placed around the piston rod and held there under tension of a garter spring. We also made a casing and cut it in half to inclose these rings and hold them in place at the outer ends of the packing-gland studs. Holes, in the bottom of the rings and in the casing, drain off the water collected by the rings.

Manissa, Ill. GEORGE HOLMAN

Mercury Contactor Speeds Coil Testing

A MERCURY-CONTACT DEVICE, suggested by R L Bainbridge, foreman at a General Electric plant, facilitates testing of coils for small motors. With former equipment, coil leads had to be heated in a gas flame and wiped with alcohol while warm to remove insulation before placing them on two copper contacts to test the coil.



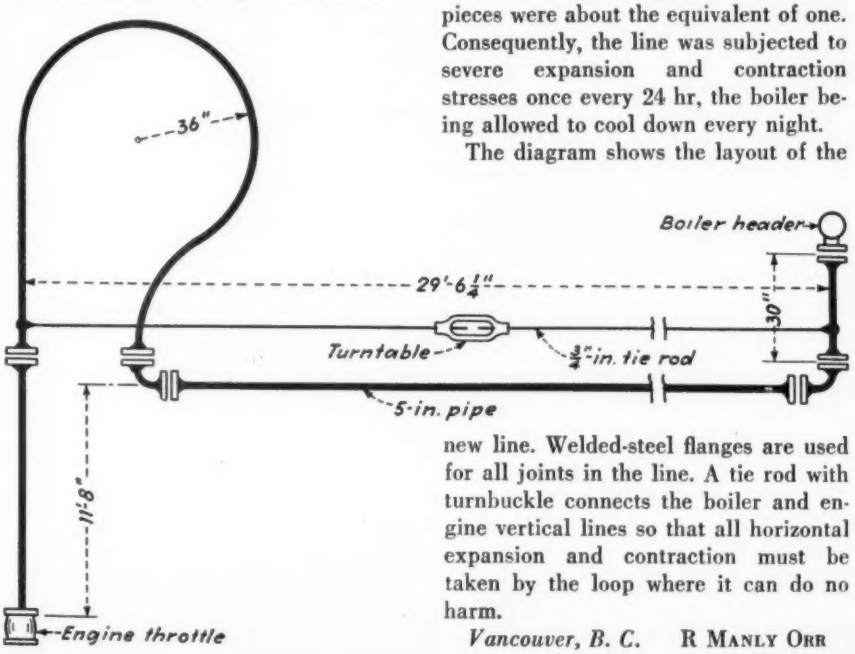
With the new device, insulation does not have to be removed because wires placed in mercury pools make contact at the bare cross-sectional area at the end. A small amount of mercury is placed in two steel wells with an opening and bushing about $\frac{1}{16}$ in. in diameter for the coil wires. Steel wells connect to the test equipment. Mercury level maintained below bottom of the bushings prevents it spilling out of the wells. One-quarter in. of water on top of the mercury serves as a safety seal. Seldom does the mercury need cleaning or replacing. Mercury contactors have made tests more positive and safer, and cut testing time 50%.

Redesigned Steam Line Relieves Stresses

THE 5-IN. STEAM LINE from our boiler to the engine, installed in 1910, leaks badly at the screwed flanges. Calking the leaks with copper wire holds dry only a day or two. We have condemned the line and are having a new one fabricated, using welded flanges at all points where expansion stress develops.

Practically no provisions were made in the old line to take care of expansion and contraction. A length of over 29 ft. ran horizontally from the stop valve on the boiler header to two elbows and a nipple that formed a horizontal and a vertical right-angle bend, sometimes called a flexible right-angle bend. From this bend the pipe ran down vertically to the engine throttle. This required the top end of the pipe to accommodate over one inch expansion and contraction. The nipple between the two elbows had been made up so tight that the three pieces were about the equivalent of one. Consequently, the line was subjected to severe expansion and contraction stresses once every 24 hr, the boiler being allowed to cool down every night.

The diagram shows the layout of the new line. Welded-steel flanges are used for all joints in the line. A tie rod with turnbuckle connects the boiler and engine vertical lines so that all horizontal expansion and contraction must be taken by the loop where it can do no harm.



Vancouver, B. C. R MANLY ORR

READERS' PROBLEMS

Questions From Our Readers

SUITABLE ANSWERS from readers will be paid for if space is available for publication. Answers that are accompanied by rough drawings or photographs will command additional pay.

Question 1

Is This Compressor At Fault?

WE HAVE a duplex 2-stage cross-compound steam-driven 100-psi air compressor operating on 150-psi steam. Air intake is inside the building where the temperature varies between 80 and 100F throughout the year. During certain hours of the day we are unable to maintain full air pressure.

It would require three 8-in. elbows and 17 ft of 8-in. pipe to run the intake outside the building. Before going to this expense we would like to know whether the resulting increase in the machine's capacity would warrant this addition.

The compressed air system contains no meters so we are unable to determine whether the compressor output is up to rated capacity. How can we determine whether the machine is operating below capacity and what tests to run to find the cause?—*RN*

Question 2

How Is This Motor Wired?

WE HAVE JUST PURCHASED a used tumbler complete with a 220-v 3-phase 60-cycle induction motor, double contactor and rotary switch for our laundry. The tumbler is supposed to reverse its direction of rotation every 15 sec. We did not receive a timing device or wiring diagram and I would like to know how to wire this equipment. Can the rotary switch be gear driven from a small motor? How must I wire the contactor control?—*FR*

Answers to May Question 1

What Causes Unequal Water Level?

We have experienced trouble for some time from low water in the middle drum of our 3-drum 8000-hp boilers.

Generally the left drum shows the highest level, the right drum a somewhat lower level and the middle drum frequently shows no water at normal ratings. Boilers are pulverized-coal fired through a single burner located 5-in. to the left of middle drum center line. Furnace contains waterwalls.

We are anxious to equalize water levels and are considering (1) installation of double burners at center lines between drums or (2) changes to circulating pipes or tubes as may be necessary.

Perhaps other readers who have had similar trouble will give us suggestions or sketches of proposed layouts that will correct this.—ANL

Scale in Rear Nipples

THE TROUBLE may be caused by restrictions in the water equalizer tubes. They should be carefully cleaned of all deposits including small quantities of soft sludge. With sluggish or unequal circulation the condition will be aggravated by faulty baffles, poor burner adjustment and uneven water feed or steam output from each boiler section. Make chemical analyses of water samples from each drum to determine relative concentrations because scale forming conditions may exist in one section. Also make a thorough internal examination of all boiler parts.

Since variation in water level between drums is caused by 0.2 to 0.5 psi pressure differential all operating factors for the three drums must be the same. The gas-flow circuit should be checked for leaking baffles or faulty dampers. A traverse of gas passages with an indicating thermometer shows faults of baffling or burner adjustment. Steam-removal system should be checked for faults that give unequal pressures.

Type of boiler is not stated but if the rating is correct it is unusual to use only one burner. It seems more probable that the units are 800-hp longitudinal drum with straight tubes. If this is so, moderately thick scale or sludge formation in the rear nipples will cause the trouble described. Cross-overs between sections will help.

Saint John, N. B. C G CLARK

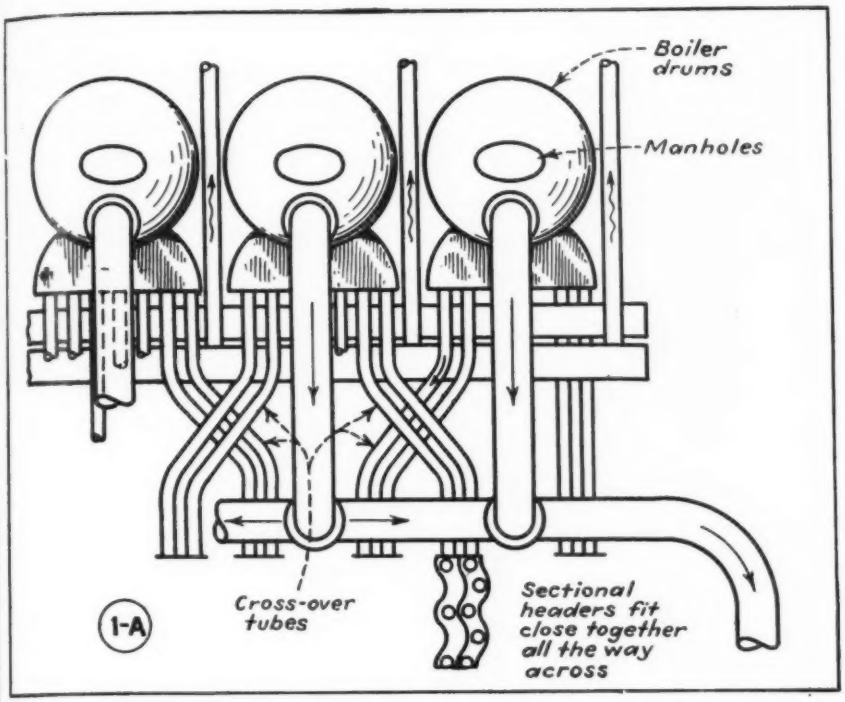
Additional Burner In Rear Wall

UNEQUAL BOILER-WATER LEVEL is caused by poor circulation, non-uniform heat absorption, concentrated heat release, faulty design or improper operation. The level should be stabilized to prevent more serious trouble.

It is impossible to trace water circulation or gas passages through a steam generator without knowing its design. The description leads one to believe it is a local reconditioned boiler with a modified furnace to accommodate waterwall tubes and additional parts, plus single-burner pulverized-fuel firing equipment, sketch 1-A. Success of this alteration depends upon shape and arrangement of parts (waterwall tubes, sectional headers and firing equipment).

ANL does not mention past performance so we assume that operation was successful prior to the unequal water level occurrence, and that there had been no change in the type of fuel necessitating a secondary air damper adjustment. Slagging on the tubes roughly indicates whether heat release is uniform or concentrated. If concentrated, secondary combustion (delayed burning of the gas) may be deteriorating the baffles (shortening the original gas passages) in the center section, thus increasing heat absorption beyond its design capacity, and overloading the center drum. A decrease in draft-pressure drop, increase in CO_2, and increase in exit-gas temperature indicates condition of baffles.

Assuming that baffles are in good condition and the designed draft-pressure drop is maintained, I recommend making a traverse of the furnace to ascertain temperatures, as well as CO_2 in accordance with ASME test codes to check actual furnace heat release. If heat release is not uniform, it may be advisable to install another



burner. In this case I suggest he locate a burner in the rear waterwall instead of the proposed front-wall two-burner arrangement.

Water circulation depends primarily upon the heat it absorbs from the fuel, metal conductor's ability to transfer heat, and the metal cleanliness internally (free from scale, sludge), and externally (slag, flyash). If the boiler is clean and there is any doubt about water circulation, pitot tubes may be installed and velocities observed as a determining factor for changing questionable pipes or tubes.

Flushing, N. Y. J P Calvert

Additional Crossovers

Fundamental cause of trouble with low water in the center drum of ANL's boiler lies in inadequate equalizer or crossover connections between the three drums to take care of the unbalance in this arrangement of boiler, waterwalls and accessories. These crossovers should connect the steam and water spaces of all three drums, as in 1-B.

Steam crossovers (a) insure practically equal steam pressure in all three drums, any tendency toward pressure differences between drums being counteracted by steam flow through the crossovers. Water crossover connections (b) when drum steam pressures are equal, insure that the water level in all drums is the same, any differences being counteracted by water flow through the crossovers. Required size and number of equalizers depend on the flow they must carry.

The unbalance itself may come from:

(1) Waterwalls may be fed from center but discharge into end drums.

(2) Inequalities in steam generation across the unit (as ANL suspects) may dump more steam into center drum than into end drums.

(3) Steam piping may take proportionately more steam from end drums than from center drum.

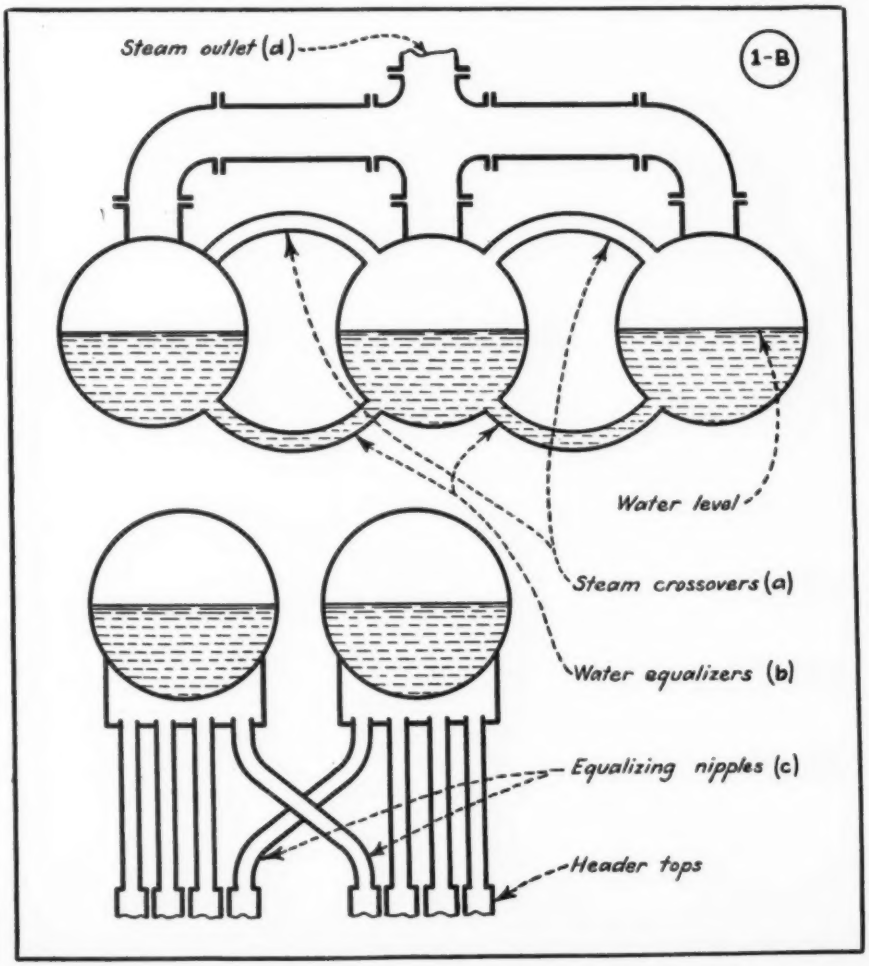
(4) Feedwater may not be distributed proportionately among drums.

ANL can seek out and remove unbalance causes or he can provide more crossover capacity. He may well find the latter course less expensive.

If this is a box-header boiler, the water crossover capacity is probably ample since it is provided by the downtake water box itself.

Steam crossover capacity is usually provided only in the outlet piping (d) but pipe size may be inadequate or there may be some peculiarity in its construction that prevents proper equalization of drum pressures. It takes only 0.3-psi difference in drum pressures to make over 12-in. difference in water level when water can flow through crossovers. Additional steam crossover capacity could be provided by increasing the size of outlet piping.

New York, N. Y. John Campbell, Jr



("*Answers to May Question 2*" *on page* 112)

Answers to May Question 2

Why Do Water Lines Contain Air?

Hot water for our 13-story apartment house goes from the basement heater directly to the 13th floor. From here the supply line drops down, feeding lateral branches that serve each floor.

We have considerable trouble from air or steam pockets on the 12th and 13th floors. Tenants complain that the line sputters with intermittent discharge of water when faucets or showers are first turned on.

Can Power readers tell me what is causing this condition and what changes I should make in the piping system?—HNF

Needs Air Relief

HNF's TROUBLE originates from air or gas liberated from the hot water. I suggest he install a small tank fitted with a float-operated air relief valve at the top of the header leading from the basement heater or at the highest point in the system, sketch 2-A. This outfit accumulates and discharges any air or gas in the water. Discharge from the air-relief valve should lead to a drain to prevent damage from water discharge.

Elmira, N. Y. M H ELKIN

Install Trap Properly

JUST AS CONDENSATE COLLECTS at low points of pipes containing steam, so does air collect in high points of pipes handling water—although ordinarily in much smaller quantities. This air interferes with the proper flow and therefore should be removed.

I had a similar problem and decided that a ball-float air trap, used as an air eliminator, would remove excess air and prevent sputtering each time a faucet was opened.

The traps were installed in the supply line at the highest point and the excess air was vented to atmosphere. Valve and outlet of the trap should be at the top for this type of service.

With no air in the system and trap filled with water, the float keeps the valve closed and allows no water to escape, but when air collects in sufficient volume to displace the water it causes the float to sink and open the valve. Air is then vented to atmosphere. As soon as the air has discharged, water returns to the body, and the float regaining its buoyancy closes the valve.

Detroit, Mich. A F SQUIER

Check Pipe Size

SEVERAL POSSIBLE CAUSES of HNF's trouble are: (1) heater pipes scaled, restricting the flow (2) pipes too small to supply the full demand and (3) new equipment that produces sudden heavy loads.

Any of these cause a reduced pressure in the higher part of the system upon extreme load and if the supply is not sufficient, a vacuum develops at these points.

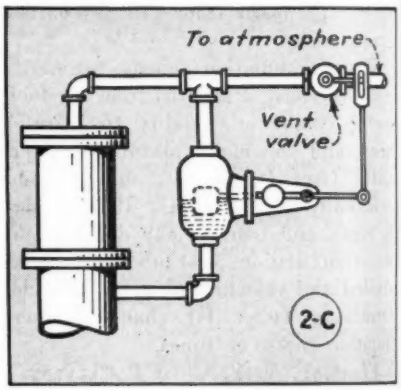
Should a valve be opened at that time or the water valves be held closed by water pressure, air would be drawn into the pipes and remain until forced out by the normal pressure and water flow.

Brandon, Man. W A WYBORN

Pipe Section For Accumulator

HNF's TROUBLE is undoubtedly caused by air and other non-condensable gas entrained in the water, which naturally travels to the highest point in the system. The remedy is to move this point still higher and install a deaerator or other bleeder to remove this gas.

I suggest that HNC add a short length of pipe at the highest point of the system to act as an air accumulator and connect a float chamber, sketch 2-C, to operate a vent valve.



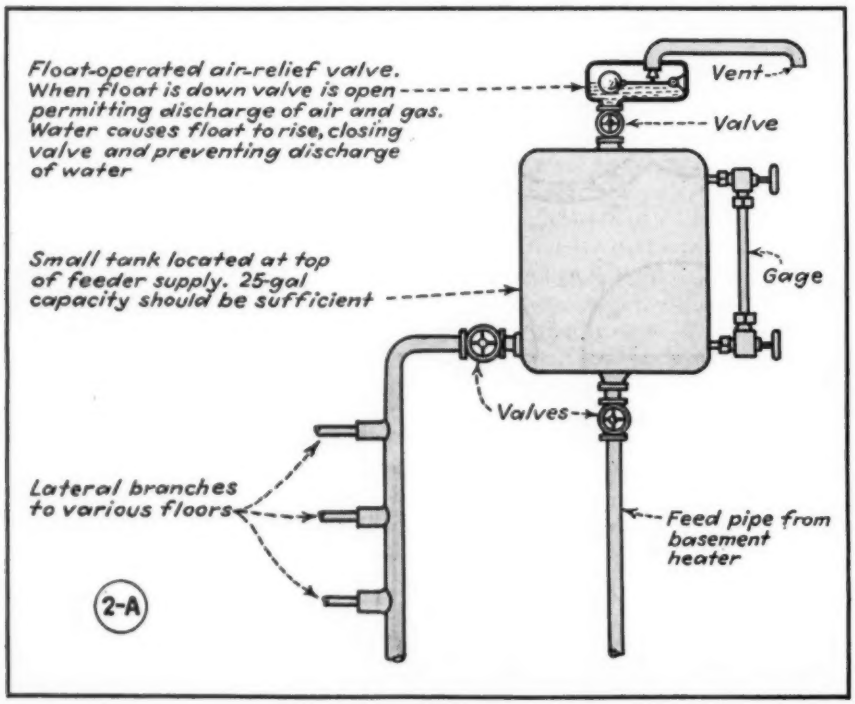
Float linkage can be adjusted so that the vent valve opens as the vapor accumulates. This insures a full volume of water to the upper floors.

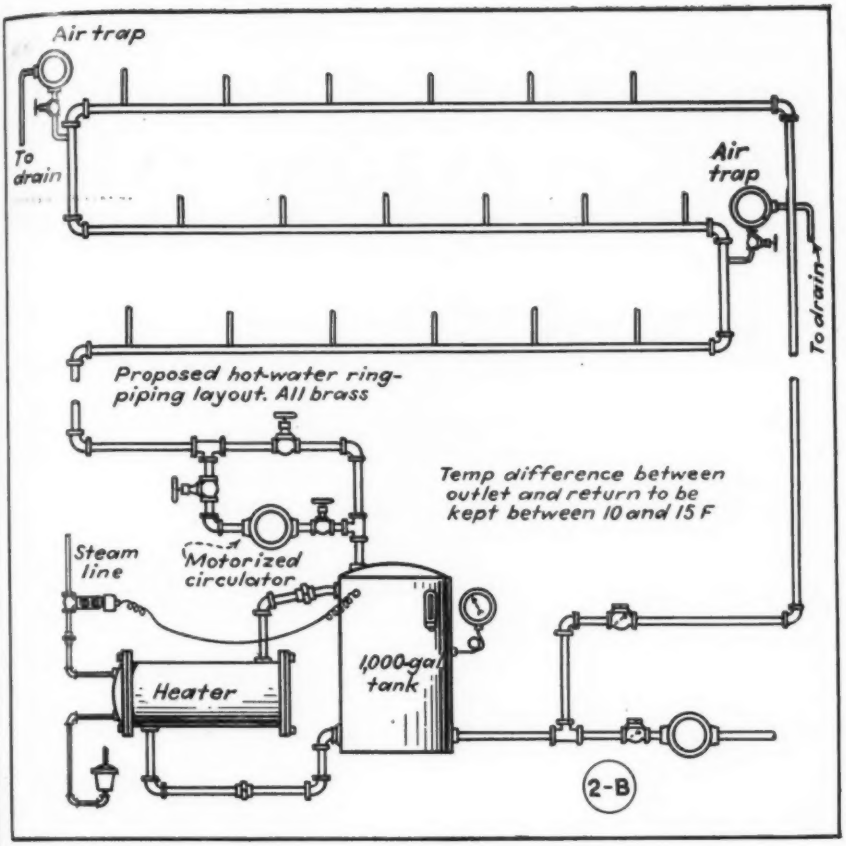
Before investing money or time, test the idea by simply installing a petcock or valve to determine whether air can be released.

Kearny, N. J. GEORGE MCNALLY

Water Flashes to Steam

TROUBLE IS PROBABLY CAUSED by insufficient pressure and too hot water. When tenant opens a faucet the sudden pressure reduction causes hot water to flash into steam. Since water pressure at top of building is fairly low, boiling point is reduced, and if the water is above 190 or 200 F this sudden pressure reduction causes spouting at faucets. A float-operated air


Float-operated air-relief valve. When float is down valve is open permitting discharge of air and gas. Water causes float to rise, closing valve and preventing discharge of water
Vent
Valve
Small tank located at top of feeder supply. 25-gal capacity should be sufficient
Gage
Valves
Lateral branches to various floors
Feed pipe from basement heater
2-A



trap in the highest part of system will rid it of any air or vapor.

The ring system with circulating pump provides best service because it supplies hot water to the tenant's faucet and with a well-insulated line heat loss would be negligible. Of course, the proper pressure must be maintained and line should be checked for partly closed valves or plugged lines as this would create a great pressure drop and cause hot water to flash to steam, sketch 2-B.

Assuming the building to be 130 ft. high, pressure to balance this column of water is 56 psi, neglecting water temperature. Pressure at the top floor would be low so the effective head should be increased to prevent steam flashing. A good thermostatic control valve keeps temperature range fairly constant.

A hand-fired heater is more difficult to control than one fitted with a stoker and complete temperature control.

Storage tank should be big enough to prevent excessive variations in water temperature as this alters the natural circulation considerably. Put a safety overpressure valve on hot-water line and remember that the higher the water temperature required, the higher the pressure must be to prevent water flashing into steam.

Ottawa, Ont. JOSEPH BONGIORNO

Check Water Supply

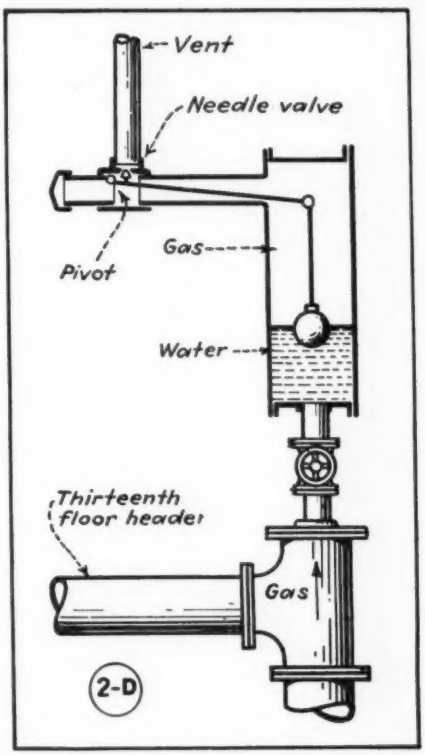
AIR MAY BE INTRODUCED in HNF's system through the pump suction line, or through leaks in the uppermost portion of the piping system if the pressure happens to drop below that necessary to maintain a head equal to the 13-story level. Most likely answer is that dissolved gas (principally oxygen) is present in the water supply. Since warm water is capable of holding only a fraction as much dissolved gas as cold water, all gas in excess of what is necessary to saturate the water must separate when the water is heated. And, being much lighter than water, the gas makes its way to the top of the system.

HNF does not mention treatment of the water prior to its use, but if it comes from the city supply it is probably aerated, in which case the problem is no doubt dissolved oxygen. Likewise, if supplied from rain or lake water without treatment the problem is dissolved oxygen. I suggest that HNF warm a sample of the supply water. If bubbles form on the sides of the beaker, the supply contains too much dissolved gas. He could feed a small quantity of sodium sulphite to the pump suction, but I do not recommend this method unless there is also pipe corrosion.

A simple solution is to install a float-controlled needle valve as in 2-D. As the gas accumulates, the float drops. This opens the needle valve, and the gas escapes. The water level then rises, raising the float and closing the valve. Needle taper should be comparatively large to minimize sticking.

Gas-escape line should extend out through the ceiling or to a drain, because the escaping moisture may cause mildew if discharged inside the building.

De Quincy, La. ADRIAN COX



Locate Vent Point Carefully

WATER AT ROOM TEMPERATURE contains dissolved air and gas and when heated the air is driven off as bubbles. Since they are lighter than the surrounding water they move upward and collect in the highest point of the piping system.

As the 13th floor is the highest point all the air released accumulates there and eventually vents by sputtering through the faucets and showers on the 12th and 13th floors. Any steam formed by excessive heating of the water acts the same as air.

A simple solution would be the periodic removal of the accumulated air and gas from the piping system. A number of manufacturers make automatic traps which vent air from piping systems without losing water.

Success depends to a large extent on

(*Continued on page* 140)

Q&A QUESTIONS & ANSWERS FOR POWER ENGINEERS

By ALEX HIGGINS

16—*Draft and Its Control*

Sixteenth in a series that is running in every number of* POWER. *From long experience as a professional and practical engineer, Alex Higgins, of Calgary, Alberta, Canada, asks and answers questions regarding power equipment.

Q 1—What is natural draft?

A—It is draft produced by a chimney alone. It is caused by the difference in weight between the column of hot gas inside the chimney and a column of cool outside air of the same height and cross-section. Being much lighter than outside air, chimney gas tends to rise and the heavier outside air flows in through the ashpit to take its place.

Q 2—How is natural draft controlled?

A—Usually by hand-operated dampers in the chimney or breeching connecting the boiler to the chimney.

Q 3—What is mechanical draft?

A—It is draft artificially produced by mechanical devices, such as fans and steam jets.

Q 4—What are induced draft and forced draft?

A—In induced-draft installations, the natural draft produced by the chimney is greatly augmented by a fan (or steam jet) between the boiler furnace and the chimney. With induced draft the pressure within the furnace is less than atmospheric.

In forced-draft installations, the fan forces air into the boiler furnace through the ashpit. With forced draft the pressure within the furnace is often higher than atmospheric pressure.

Q 5—How is induced draft produced by a fan and by a steam jet?

A—Fig. 1 shows an induced-draft-fan arrangement on a small boiler. The fan is placed between boiler and chimney. It draws the products of combustion from the boiler furnace and discharges them into the chimney.

Fig. 2 shows a means of creating induced draft by placing a steam jet in a chimney. The use of steam jets for draft purposes is pretty well confined to locomotive and small portable boilers.

Q 6—What are the main characteristics of forced draft?

A—Forced draft often (but not necessarily) maintains a pressure above atmospheric in the boiler setting, so flue gas may be forced out into the boiler room through cracks or leaks in the setting. Such leakage should not be important with a boiler setting in good condition. Where boilers are hand fired, flame may shoot out of firing doors if the draft is not cut out before the doors are opened. However, hand firing with forced draft is not common.

Forced draft is commonly used with underfeed stokers as considerable pressure is needed to force the air needed for combustion up through the deep fuel bed. In general, all types of large boilers operated at high ratings are normally equipped with forced draft.

Forced-draft fans may draw their air supply from the boiler room or from air preheaters, the latter being widely used with large boiler units.

Q 7—What are the main characteristics of induced draft?

A—Induced draft creates a partial vacuum in the boiler furnace so there is no likelihood of furnace gas leaking out through cracks in the setting. If any cracks are present, air is drawn in and it may reduce furnace efficiency considerably. Because of this, induced draft may not be as satisfactory as forced draft where solid fuel is fired, and the fuel bed is thick, but it may fit the requirements of small or medium-sized plants where furnaces are hand fired, equipped with overfeed stokers of certain types, or where boiler fuel is oil or gas.

Induced-draft fans are of similar construction to forced-draft fans, but are usually of the single inlet type, and larger than forced-draft fans for the same boiler output, because the hot flue gas is much greater in volume than the air originally fed to the furnace. Induced-draft fans are also likely to deteriorate more rapidly than forced-draft fans as they are exposed to higher temperatures, cinders and possible corrosive action.

Q 8—What is balanced draft?

A—This term is usually applied to a combination of forced and induced draft automatically regulated to keep the boiler furnace at approximately atmospheric pressure.

Q 9—What is automatic draft control?

A—It is the automatic regulation of fans and dampers to increase or decrease air flow to maintain constant steam pressure as the load changes, and also to maintain good combustion conditions. Devices to control draft-fan speed and damper position frequently employ diaphragms. Changes of air or steam pressure act upon the sensitive

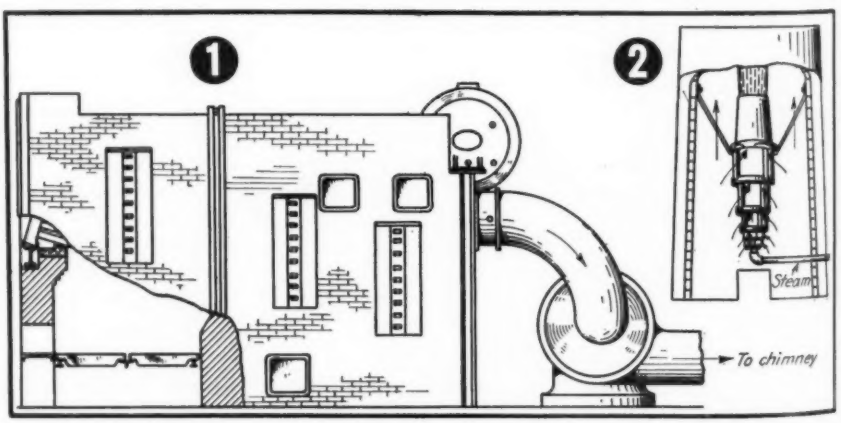


Fig. 1—Application of an induced-draft fan to a small hand-fired boiler. Fig. 2—Arrangement of a steam jet in base of a stack to increase draft

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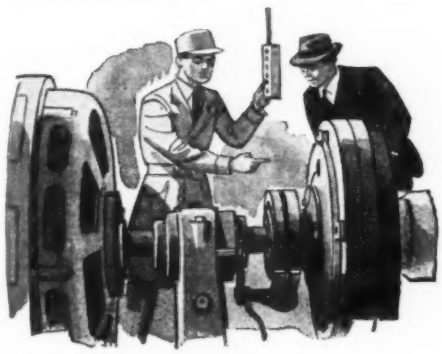

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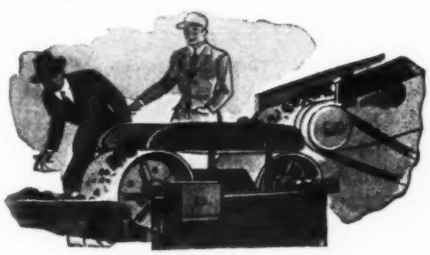

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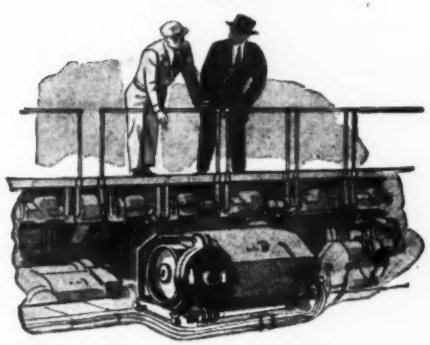

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Q&A FOR POWER ENGINEERS

(*Continued from page* 114)

diaphragms to open or close the electrical switches, fluid valves or steam valves that control fan speed or damper position.

Q 10—Explain operation of balanced-draft control.

A—In Fig. 3 the fan speed is controlled to burn coal fast enough to hold the steam pressure constant at all loads. The damper's position is adjusted to "balance" the draft—that is, to maintain practically atmospheric pressure in the furnace.

The balanced draft regulator is a large diaphragm exposed on one side to furnace pressure conveyed through a draft tube built into the wall of the setting. Movement of this diaphragm operates a pilot valve that admits water or air under pressure to the damper control cylinder, causing the piston to adjust the damper. When the damper takes up its new position, the furnace pressure comes back to normal and the diaphragm returns to its original position, no further movement taking place until another change occurs in the furnace pressure. The action of the diaphragm under furnace pressure is opposed by springs that can be adjusted to secure any desired pressure within the range of the regulator.

Fan speed is controlled by a steam-pressure regulator operated by rise or fall of steam pressure in the steam main. If steam pressure falls a little, the regulator opens the fan engine's throttle valve to speed up the fan sufficiently to carry the higher load.

Q 11—What advantages has mechanical draft over natural draft?

A—Mechanical draft is independent of wind or temperature changes. After the limit of combustion is reached with natural draft more fuel may be burned and the boiler capacity increased by installing mechanical draft—also poorer grades of fuel may be burned than with natural draft. Where a very thick fire is carried, as for underfeed stokers, mechanical draft must force air through the thick fuel bed. Also, when economizers are placed between the boiler and chimney to utilize heat from the waste flue gas, mechanical draft is essential to overcome the resistance offered by the banks of tubes in the economizer.

Q 12—Why is a chimney necessary?

A—It creates natural draft where no draft fans or blowers are used and discharges the products of combustion at such a height that they will not be a nuisance to the surrounding community. Where mechanical draft is used the second reason is the main one.

Q 13—What are the common types of chimneys, and the advantages and disadvantages of each?

A—Chimneys are built of steel, brick or concrete. The steel chimney is usually the cheapest and most easily erected, but it requires more care and attention if it must last a comparable time. Unless the outside is kept well painted a steel stack deteriorates rapidly from the action of the weather, and the flue gas corrodes the inner surface if it has no protective lining. Also, the excessive heat loss through an unlined steel stack reduces the draft produced, hence practically all permanent steel stacks are lined with firebrick or some other fire-resisting material. A common practice in building this lining is to use firebrick for the base section where the heat is most intense and common brick for the rest of the distance to the top.

Steel chimneys may be self supporting, in which case the base flares out to about twice the upper chimney diameter and is bolted to a substantial concrete foundation. If the chimney is not self supporting it is kept upright, and braced against wind pressure by steel guy wires or cables with one end anchored

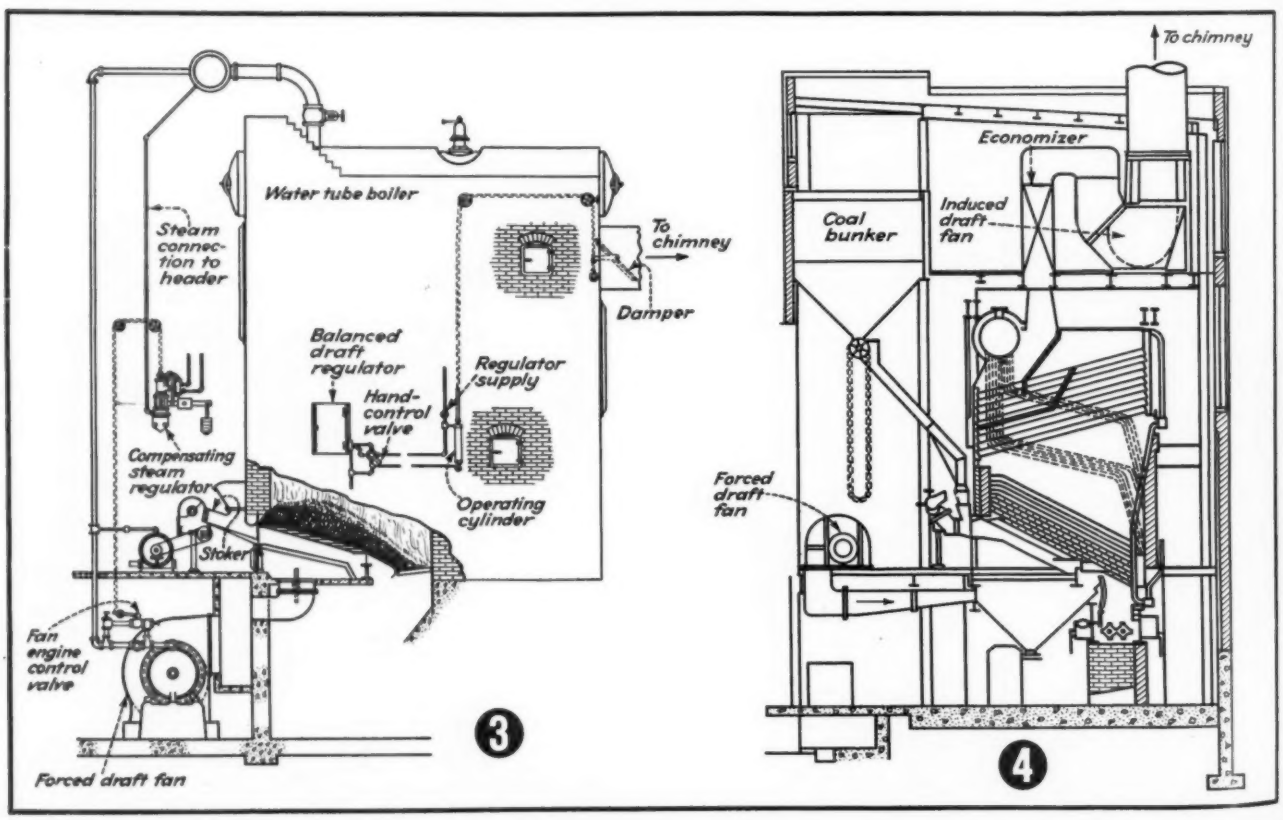
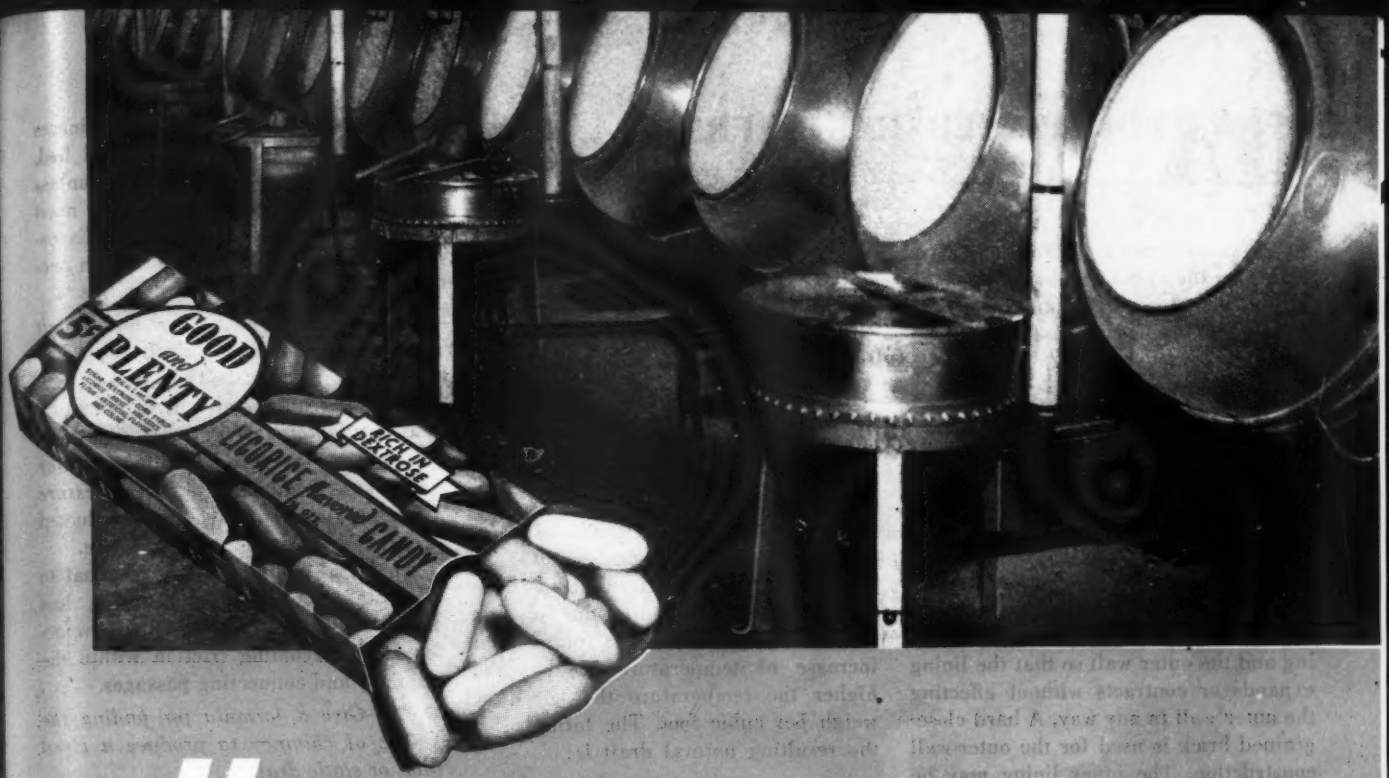


Fig. 3—Installation of balanced draft. Fig. 4—Stoker-fired boiler with economizer and forced- and induced-draft fans



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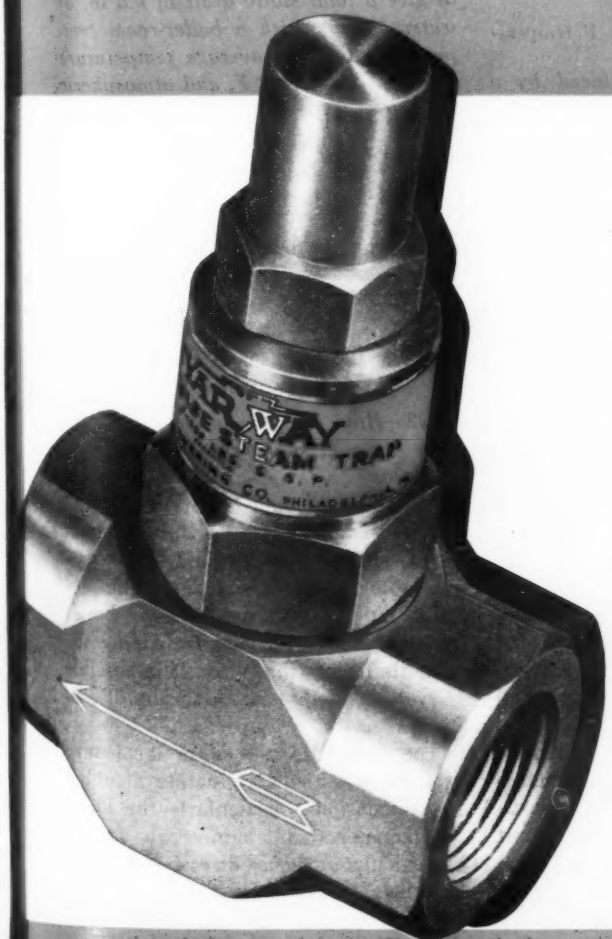

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(*Continued from page* 116)

in the ground and the other fastened to a ring on the chimney, about two thirds of the height from the bottom. Small steel stacks are usually of uniform diameter throughout, but large stacks, especially the self-supporting type, may be tapered gradually from bottom to top.

The brick chimney is more expensive to build than the steel but it lasts longer and stands weathering much better. Brick is usually built with a uniform inside diameter from bottom to top but a decreasing outside diameter. In the best construction, an inner lining is used with an annular space between the lining and the outer wall so that the lining expands or contracts without affecting the outer wall in any way. A hard close-grained brick is used for the outer-wall construction. The inner lining may be all firebrick, or firebrick part way up from the base and common brick the rest of the way. Rectangular bricks can be used for chimney building, but specially shaped radial bricks make a stronger and neater job.

Chimneys are also built of reinforced concrete. This type can be built rapidly, yet it is very strong because of the steel reinforcing. The chimney is practically airtight and less likely to have air leakage than a brick chimney with its multitude of joints. Walls may be thinner than brick, thus giving a lighter construction without sacrificing strength. A concrete chimney should also have an inner refractory lining at least part of the way up from the base.

Q 14—What are the principal points to observe when designing a chimney?

A—They are: (1) Height must give the desired draft. (2) Cross-sectional area must be sufficient for boiler load served. (3) Foundation must be solid and substantial. (4) Base must support the weight. (5) Chimney must resist maximum wind pressure to which it is likely to be exposed. (6) It must have high resistance to the weathering action of wind, rain, heat and cold. (7) A good inner lining should protect the inside of the chimney and prevent excessive heat loss through radiation.

Q 15—Why are chimneys lined and what materials are used?

A—All types should be lined to prevent damage from the effects of unequal expansion due to the difference between flue-gas temperature inside the chimney and that of the outside air. The lining also protects against the corrosive action of the products of combustion passing up the chimney and can be renewed without rebuilding the entire chimney. Leave a space between the lining and the main wall, and do not bond the lining to the outer wall. The chimney may be lined completely or only part way up. Concrete, common brick, firebrick and other refractory materials are used for chimney lining.

Q 16—Give a formula for calculating the draft that can be produced by a chimney of a given height.

A—The following formula is commonly used. It is based on the fact that air and flue gas expand in volume with increase of temperature so that the higher the temperature the less they weigh per cubic foot. The formula for the resulting natural draft is:

$$D = 0.52 \times H \times P\left(\frac{1}{To} - \frac{1}{Tc}\right)$$

Where D = draft pressure, inches of water
H = height of chimney, feet
P = atmospheric pressure, psi absolute
To = absolute temperature of outside air, deg F
Tc = absolute temperature of chimney gas, deg F

Note: absolute temperature is F temperature + 460

Q 17—What draft is produced by a chimney 100 ft high. Temperature of chimney gas 500 F, outside temperature 60 F, atmospheric pressure 14.7 psi?

A— $To = 60 + 460 = 520$
$Tc = 500 + 460 = 960$

$$D = 0.52 \times H \times P\left(\frac{1}{To} - \frac{1}{Tc}\right)$$

$$= 0.52 \times 100 \times 14.7\left(\frac{1}{520} - \frac{1}{960}\right)$$

$= 764\ (0.00192 - 0.00104)$
$= 764 \times 0.00088$
$= 0.67$ in. Answer

Note that this is not the *net* draft the chimney would produce with a boiler carrying a load. Instead it is the *static* draft, that is, the draft the hot gas in the stack would produce if there were no flow of gas up the stack. In actual operation the gas encounters resistance flowing up the stack, and this uses up part of the total draft as computed by the formula just given. This draft loss in the stack increases with the rate of fuel burning and is much greater for a small diameter than for a large-diameter stack. To keep it within reasonable limits the cross-sectional area of chimney opening must be increased almost in proportion to the amount of coal burned by the boilers it serves.

Q 18—Is a higher or a lower chimney needed when burning oil or gas fuel than when burning coal?

A—Use of oil or gas fuel eliminates the resistance of grates and fuel bed, hence permits a lower chimney unless (and this is important) the stack must allow for shifting over to coal. Excessive draft from a stack higher than necessary can be reduced by dampers.

Q 19—What is meant by total draft pressure and available draft pressure?

A—The formula in Q 16 and 17 calculates the *total* static draft pressure. The *available* draft is the draft at any point from the ashpit to the chimney top that is available after the *pressure drop* to that point has been deducted from the total static draft pressure.

The total available draft is equal to the total theoretical static draft, less the pressure used up in producing velocity and overcoming friction within the chimney and connecting passages.

Q 20—Give a formula for finding the height of chimney to produce a given total or static draft.

A—Transposing the formula given in question 16:

$$H = \frac{D}{0.52\ P\left(\frac{1}{To} - \frac{1}{Tc}\right)}$$

Q 21—What chimney height is required to give a total static draft of 0.8 in. of water column with a boiler-room temperature of 90 F, average temperature of chimney gas 500 F, and atmospheric pressure 13 psi?

A— $To = 90 + 460 = 550$
$Tc = 500 + 460 = 960$

$$H = \frac{0.8}{0.52 \times 13\left(\frac{1}{550} - \frac{1}{960}\right)}$$

$$= \frac{0.8}{0.52 \times 13\ (0.00182 - 0.00104)}$$

$$= \frac{0.8}{0.52 \times 13 \times .00078} = \frac{0.8}{.00527} = \frac{800}{5.27}$$

$= 152$ ft. Answer

Q 22—How do you find the chimney area for a given height and coal consumption?

A—There are many different formulas for finding chimney area, but all are of a rule-of-thumb nature and give undependable results. The type of chimney construction, method of firing, boiler and furnace design, etc, are among the variable factors that make it impossible to evolve a single formula to suit all conditions.

The only safe procedure is to turn over the actual determination of chimney dimensions, particularly the internal diameter, to an engineer who is able to calculate them directly from a knowledge of the engineering principles involved and who has full knowledge of the boiler and furnace design, baffling, firing method, load conditions, etc.

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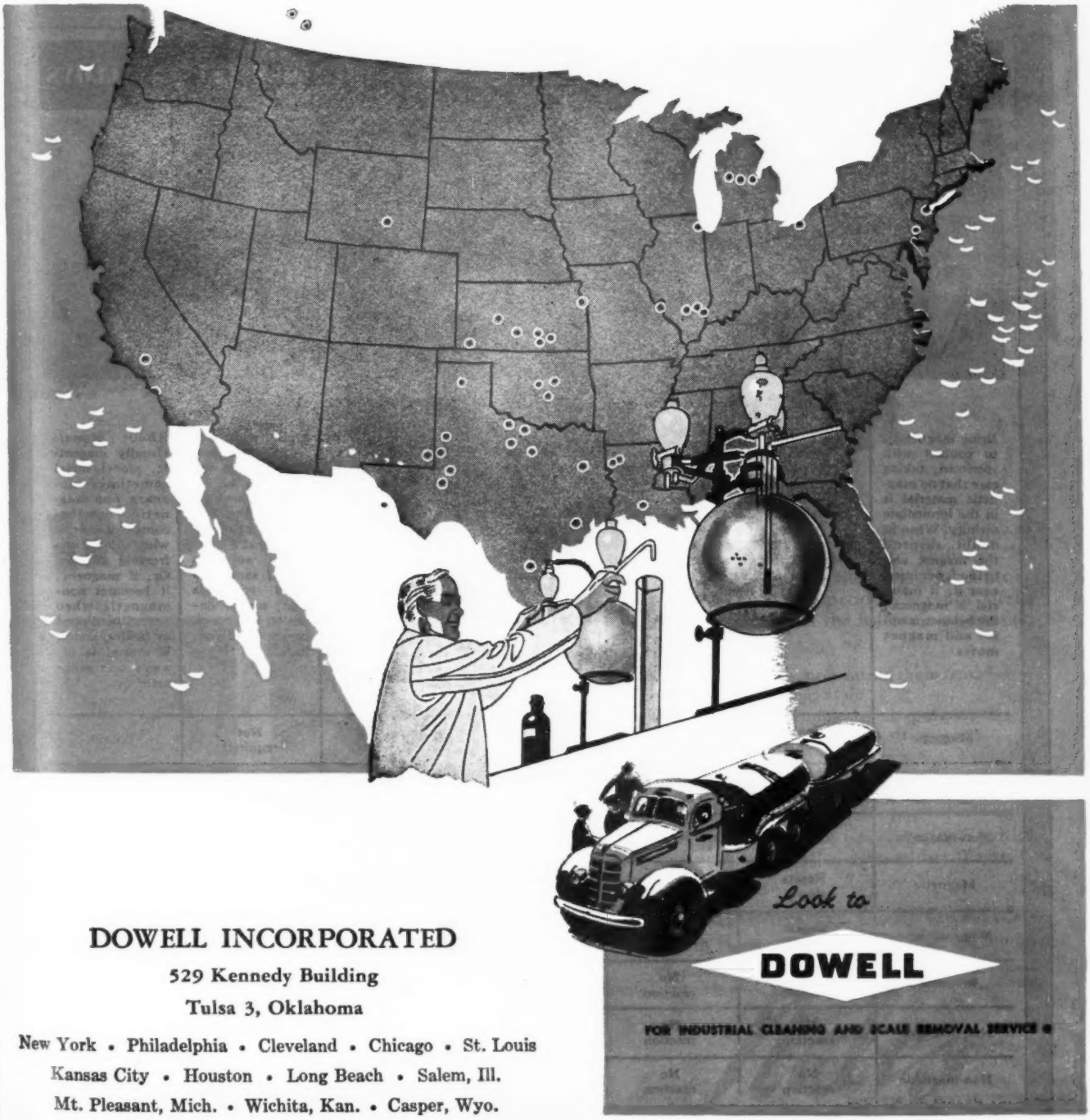

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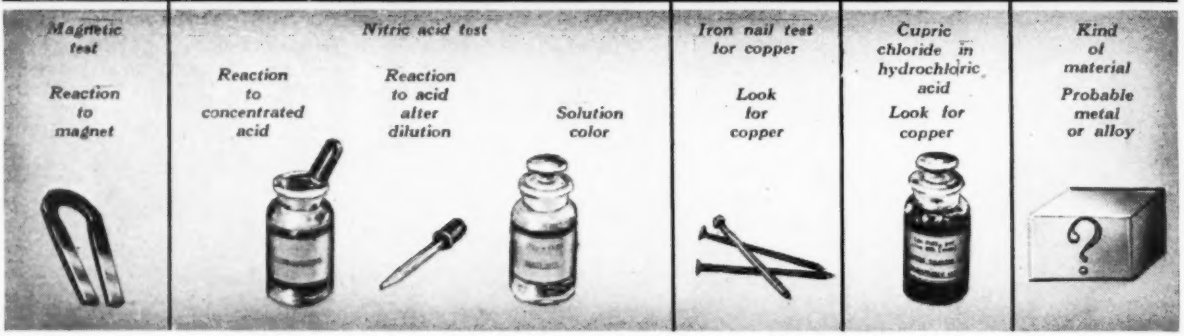
HOW TO IDENTIFY WHITE METALS & ALLOYS

SINCE MANY ALLOYS have the same general appearance and two materials mutually unsuited for each other's use may become interchanged, it is not safe to rely on the eye test for identification. Mix-ups are liable to occur in spare-part storage and repair shop where dissimilar stock materials are used to fabricate new parts or repair worn ones.

With the aid of inexpensive materials, identify many of the alloy metals with these simple tests: (1) magnetic (2) nitric acid (3) iron- or steel-nail test—for presence of copper (4) cupric-chloride solution. Behavior of eight familiar metals under test is given in table.

Equipment needed is: (1) a good permanent magnet (2) concentrated nitric acid (3) solution of 10 grams of cupric chloride in 100 cc of concentrated hydrochloric acid (4) small quantity of distilled water. Always use an individual pipette for each solution. *Courtesy, The International Nickel Co, Inc.*

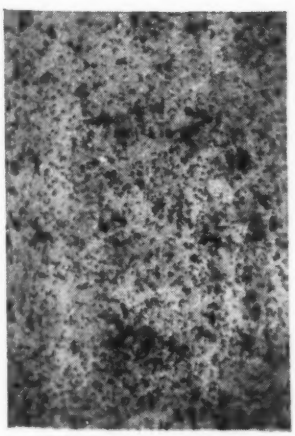
QUALITATIVE TESTS FOR IDENTIFYING COMMON WHITE METALS AND ALLOYS



HOW TO MAKE THE TESTS AND IDENTIFY THE DIFFERENT METALS

Magnetic test	Nitric acid test			Iron nail test for copper	Cupric chloride in hydrochloric acid	Kind of material
Reaction to magnet	Reaction to concentrated acid	Reaction to acid after dilution	Solution color	Look for copper	Look for copper	Probable metal or alloy
Bring magnet into contact with specimen, taking care that no magnetic material is in the immediate vicinity. When in doubt, suspend the magnet and bring specimen near it; if material is magnetic, the balance is upset and magnet moves.	In the nitric acid test, the surface of the test piece should be clean to insure direct contact between the acid and the metal. One or two drops of concentrated acid are then applied, and after a minute or two any reaction that takes place can be observed. After this reaction has been noted, the acid should be diluted with three or four drops of distilled water, one drop at a time. Should the solution turn either green or blue, the third, or so-called nail, test should be used.			Rub a clean iron nail in the acid on metal surface, keeping contact with specimen. If alloy contains copper, it deposits either on the nail or metal. Finally, add a drop or two of water to prevent deposited copper from redissolving.	Apply a drop of cupric-chloride-acid solution and allow it to remain for two minutes. Then add four drops of water, one at a time. Wash solution off. If sample is 18-8 stainless iron, copper deposits; if Inconel, no copper deposits.	*About Monel:* Usually magnetic, monel metal sometimes appears non-magnetic, but becomes magnetic when dipped in a freezing mixture. Or, if magnetic, it becomes non-magnetic when heated or dipped in boiling water. K-monel is always non-magnetic.
Magnetic	Reacts slowly	Reacts slowly	Pale green	No copper plates out	Not required	Nickel
Magnetic (slightly)	Reacts	Reacts slowly	Greenish blue	Copper plates out	Not required	Monel
Non-magnetic	Reacts	Reacts	Bluish green	Copper plates out	Not required	Copper-nickel alloy containing less than 60% nickel
Magnetic	Reacts slowly	Reacts	Brown to black	Not required	Not required	Steel or cast iron
Non-magnetic	Reacts slowly	Reacts	Brown to black	Not required	Not required	Ni-Resist
Magnetic	No reaction	No reaction	Colorless	Not required	Not required	Straight chromium stainless steel
Non-magnetic	No reaction	No reaction	Colorless	Not required	Copper deposits when drop is diluted	Chromium-nickel stainless steel 18-8
Non-magnetic	No reaction	No reaction	Colorless	Not required	No deposition of copper	Inconel

IN A GLASS BOILER



50 DIAMETERS
Actual boiler water treated with common chemical but uncoagulated.

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HEATING, VENTILATING, AIR CONDITIONING GUIDE
APPLIED SAFETY ENGINEERING . . *By H H Berman and H W McCrone*
ENGINEER'S DICTIONARY—SPANISH-ENGLISH AND ENGLISH-SPANISH . . *By L A Robb*
BASIC MATHEMATICS FOR ENGINEERS . . . . *By Paul G Andres, Hugh J Miser and Haim Reingold*
CONVEYORS AND RELATED EQUIPMENT . *By W G Hudson*
CONTROL OF ELECTRIC MOTORS . . . . . *By P B Harwood*
PRACTICAL DESIGN OF WELDED STEEL STRUCTURES . . *By H M Priest*
THERMODYNAMICS . . . *By the late J E Emswiler*
BOOKLETS . . . . . *Brief reviews*

Electronics

INDUSTRIAL ELECTRONIC CONTROL (1944) *By W D Cockrell, industrial engineering division, General Electric Co. Published by McGraw-Hill Book Co, 330 W 42nd St, New York, N. Y. 247 pages, 5½x8 in.; 188 illustrations; cloth.* $2.50.

Industrial electronic equipment has, in a few years, mushroomed to where it performs myriad functions in power generation and applications and industrial processes. As a result, power-and-industrial operating and application engineers in general lack the knowledge to deal intelligently with these new and versatile tools. To correct this situation an extensive program of practical electronic education is required in which this book will fill a vital need. Written for practical men, in simple language, void of mathematics, it describes the fundamentals of electron-tube operation and basic control circuits in common use.

The work is divided into four parts. Part I: different designs of electron tubes; their construction and operation. Part II: basic circuit components; the fundamental nature of resistance, capacity and inductance; operation of instruments used in electronic circuits. Part III: Basic electronic circuits classified into general types and their necessary parts; operation and common application of each. Part IV: how to analyze a complicated circuit and divide it into its component parts using standard commercial equipment for illustrations. Appendix includes helpful charts and tables in electronic work. Everyone interested in industrial electronics will find this practical book helpful in a great many ways.

Streamlined Calculus

CALCULUS REFRESHER FOR TECHNICAL MEN *By A Albert Klaf. Pub by McGraw-Hill Book Co, 330 W 42nd St, New York 18, N. Y., 1944, 431 pages, 5½x8½, cloth,* $3.

As far as math books are concerned, this is something new under the sun. Mr Klaf presents the differential and integral calculus entirely by questions and answers—756 altogether. The fast-moving Q-and-A technique has been very popular in other fields and may well win new fans for calculus.

While the book is designed chiefly for those who have previously studied calculus in more lengthy volumes, it should be understandable to any person with a good foundation in high-school mathematics.

A final section is devoted to applications of calculus in various fields of technology.

Material Handling

CONVEYORS AND RELATED EQUIPMENT (1944) *By Wilbur G Hudson. Published by John Wiley & Sons, 440-4th Ave, New York 16, N. Y. 341 pages, 5½x8½; illustrated; tables; cloth.* $5.

Our industrial economy is built around material-handling methods. Without coal-handling equipment our great steam power plants would not be possible. Nor could steel, paper, cement, chemical and many other plants function without conveying machinery. Mass production in industry depends on conveying systems, and expansion in mass production invariably follows improvements in material-handling methods.

This book presents a broad general picture of material-handling problems and equipment available for their solution and its application. The first chapter, "General Principles in the Selection of Conveyors," lays down general principles to steer engineers away from the many pitfalls that await the uninitiated in material handling. This chapter warrants study by every engineer because of its many useful pointers on material handling. It is followed by chapters on: screw conveyors, flight and apron conveyors, bucket elevators, skip hoists, pivoted-bucket carriers, overhead trams and conveyors, en masse conveyors, pneumatic and hydraulic conveyors, belt conveyors, aerial trams, storage and transport, bins and bunkers, unloading waterborne cargoes, crushers and pulverizers, screens and feeders, car unloading, weighing, drives and boiler-plant coal-handling equipment. Treatment is practical, dealing with the equipment's construction, operation and applications. Assisting in the latter are many charts and tables.

Mathematics

BASIC MATHEMATICS FOR ENGINEERS *By Paul G Andres, Hugh J Miser and Haim Reingold. Pub, 1944, by John Wiley & Sons, 440-4th Ave, New York, N. Y., 726 pages, 5½x9, cloth,* $4.

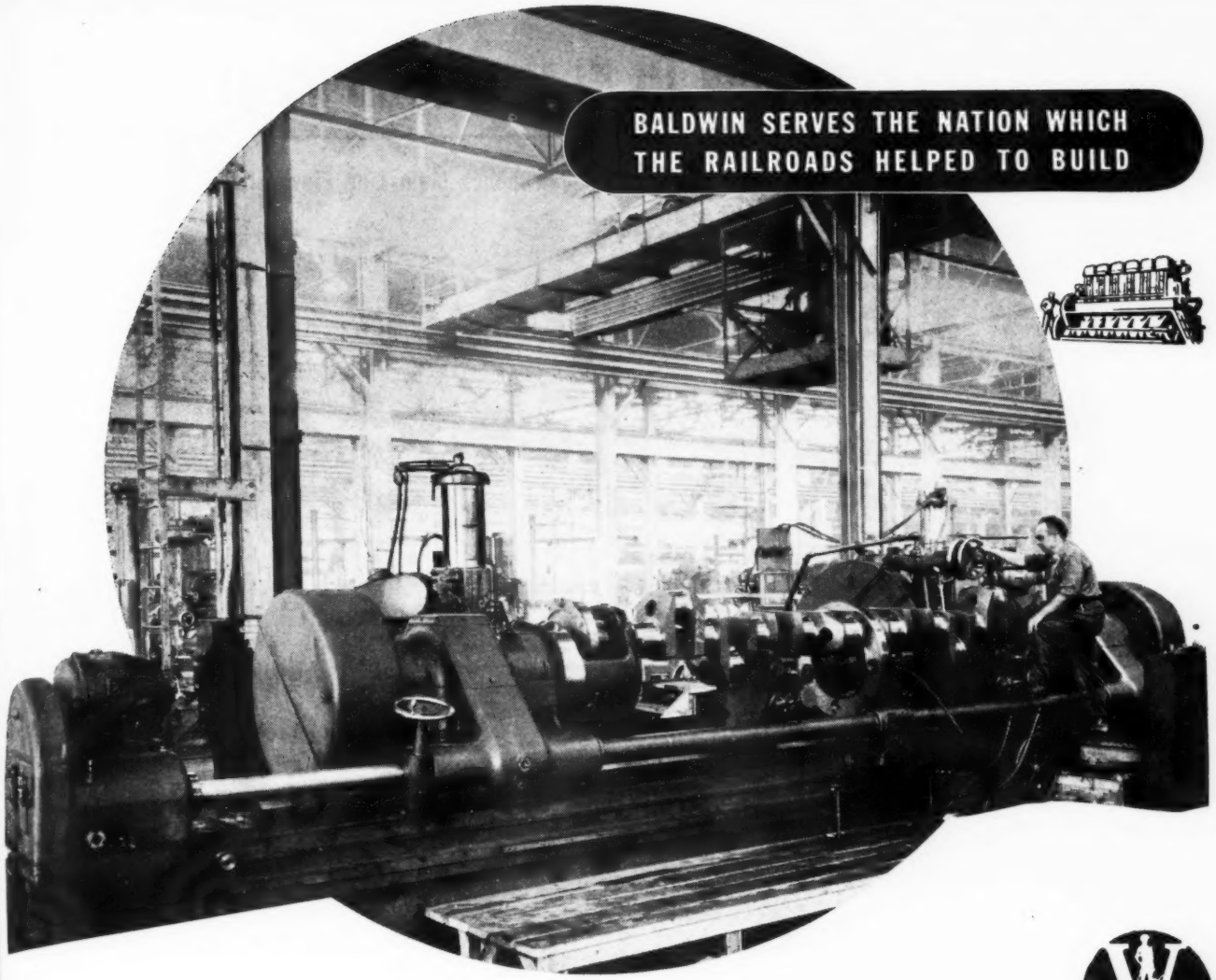
Designed primarily as a school textbook, this volume serves equally well for review "homework" of practical engineers. It assumes that the student has had two years of high-school mathematics. Many illustra-

(*Continued on page* 148)

How to Insure Receiving POWER Regularly

With circulation volume frozen by wartime paper restrictions, POWER's present subscribers enjoy a preferred position. We now have a waiting list of more than 1500 engineers anxious to receive POWER editorial service, more valuable than ever in these busy days. Naturally, we give priority to regular readers, provided that renewal orders reach us before the actual expiration date. If the renewal fails to reach us in time, we have no choice but to treat it as a new subscription, which means the waiting list and missing anywhere from one to three issues. Furthermore, we cannot supply missing copies.

To avoid this loss of service, please cooperate with us by sending in your order on receipt of the *first* renewal notice. By so doing, you retain your priority and receive all issues.



This Crankshaft Grinder

Means Better Diesel Performance for You

BALDWIN
PRODUCTS

Hydraulic presses, Testing equipment, Steel forgings and castings, Diesel-electric locomotives, Diesel engines, Metal plate fabrication, Rolled steel rings, Bronze castings, Heavy machine work, Crane wheels, Bending rolls, Plate planers, Babbitt metal, Alloy iron castings, Briquetting presses.

BALDWIN
DIESEL ENGINES

Here is one of the reasons why your Baldwin Diesel engine will give you something more in economy, service and all-round satisfaction.

It is one of the world's largest crankshaft grinders, recently installed to finish an essential part of the engine to within one ten-thousandth of an inch—plus or minus—of designed dimensions, and, at the same time, insure accurate parallelism.

A trip through the Baldwin shop would show you many examples of this emphasis on ultimate quality and accuracy—skilled craftsmen who know how to do a *plus* job . . . and machines that help them to do it.

This means extra work and expense . . . but when you purchase your next Baldwin Diesel, you'll recognize the fact that it also means better Diesel performance for you.

The Baldwin Locomotive Works, Locomotive & Ordnance Division, Philadelphia, Pa., U. S. A. Offices: Philadelphia, New York, Chicago, Washington, Boston, Cleveland, St. Louis, San Francisco, Houston.

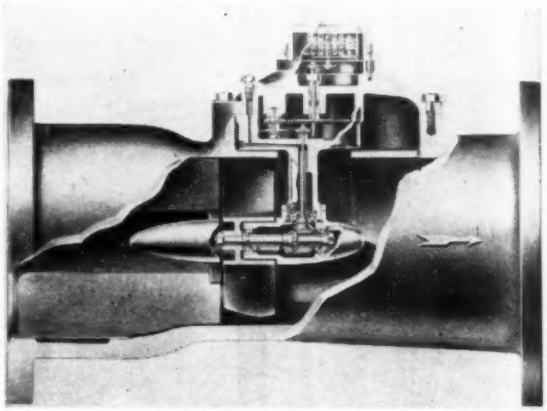
WHAT'S NEW IN PLANT EQUIPMENT

Welding Torch

TORCHWELD AIRCRAFTER, a compact lightweight welding torch, for delicate, precision work in *hard-to-get-at* light metal work, is ideal for women welders. Two copper tip styles, are said to produce soft medium-pointed flames that give deep penetration without blowing hot metal. Both models may be swiveled to any position. Tip head for screw-in style tips is of heat resistant cupro-nickel. Mixers incorporate Torchweld *non-flash* principle. *National Cylinder Gas Co, 205 W Wacker Dr, Chicago 6, Ill.*

Propeller Main-Line Flowmeter

PROPELOFLO METER for main-line metering has many improvements, including streamlined Venturi construction. Unit has an 8-blade Bakelite propeller molded in one piece. Rotation is transmitted through spur and bevel gears. Shafts rotating in ball bearings assure maximum power to drive indicating and recording devices or proportioning chemical feeders. Flowmeter measures liquid flow in 6-in. lines and larger. *Builders-Providence, Inc, 9 Codding St, Providence 1, R. I.*



Electronic Flow-Control

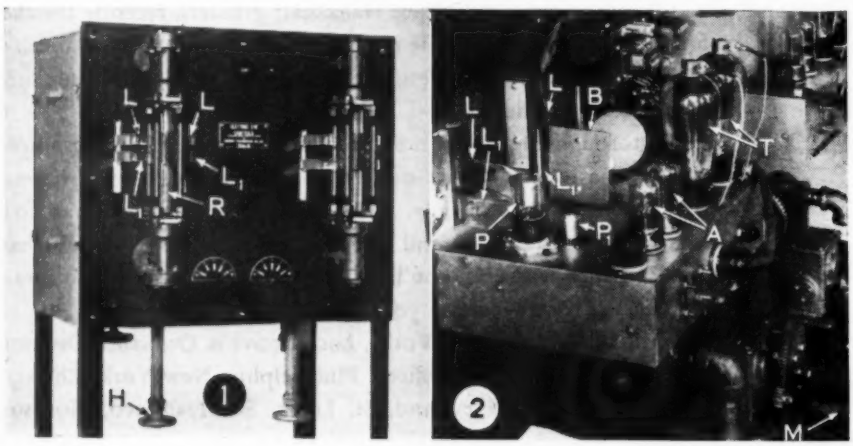
A NEW ELECTRONIC FLOW-CONTROL automatically adjusts flow in one or more lines according to a preset rate. A rotameter *R* on a panel, Fig. 1, meters flow. A lamp back of plate *B* and two photoelectric tubes *P* and P_1, Fig. 2, connect by four pieces of lucite *L* and L_1 to liquid column of meter. Lucite pieces *L* transmit light from lamp across liquid column to photo tube *P*. Similarly, lucite pieces L_1 conduct light from lamp to tube P_1. Photo tubes connect to two amplifying tubes *A* and two thyratrons *T*; the latter power a reversing motor *M* on the flow-control valve.

Correct rate of flow holds rotameter float between the two light beams across fluid column. As long as meter float remains in correct flow position between light beams, system is in balance. If flow changes and float goes up or down as little as 0.01 in., sufficient light is cut off from one photo tube to cause control to correct the flow. Control is compensated to prevent hunting or overtravel, motor speed being proportional to distance float moves away from control point.

Because of two light beams, one above the other across the liquid column, changes in fluid color cancel out and do not cause control operation. Line-voltage changes up to ±10% do not affect control. Failure of lamp or an electronic tube closes the control valve and sounds an alarm. No hysteresis lag occurs in control for up-or-down movement of meter float. Two light beams cause control always to bring the float back to normal position even if something happens to throw it outside the light beams. Handwheel *H*, Fig. 1, provides adjustment up or down to position lucite bars on meter column for any desired flow. A rotary switch permits changing from automatic to manual control. *Brooke Engrg Co, 4517 Wayne Ave, Philadelphia, Pa.*

Truck Pump

OUTSTANDING CONSTRUCTION feature of new pump appears to be the double bearing arrangement, one on each side of rotor, which should eliminate shaft *whip* and distortion. Pump operates on *bucket design* principle. Compact and light in weight, it is suitable for mounting on small trucks. It is designed for standard power-take-off drive, with capacity of 35 gpm at 525 rpm. Normal operating pressure is 45 psi. Relief valve, built into pump casing, will bypass entire pump capacity without shock or end-thrust on working parts and is free from *chatter*, according to maker. Provision may be made for mounting a standard Blackmer Ezy-Kleen T-strainer in the pipe, near or remote from the pump suction. *Blackmer Pump Co, Grand Rapids 9, Mich.*



Self-Lubricating Valve

PLUG VALVE, through its own operation, lubricates all its moving surfaces. Manufacturer states that hydraulic force assures a complete lubricant flow to every moving surface each time valve is given a quarter-turn to open or close. To prevent lubricant entering line, or being dissipated through contact with gas or fluid, Waddell plug valve channels are designed so that they do not open into line flow, regardless of valve position. If gasket becomes damaged, stud bolts and top cap hold plug in position and prevent leakage. *Lancaster Valve Co, Lancaster, Ohio.*

Boiler Tube Expander-Driver

ANGLE TOOL ATTACHMENT provides the link between tube expander and driving unit, states the manufacturer, making it easy to get at hard-to-reach spots. Invincible expander-driver works in right- or left-hand corners. They are in two standard sizes with ¾- and 12-in. square driving chuck. Ball thrust take-up takes thrust both forward and reverse for smooth operation. Bearings take all thrust action, allowing instant reversal of driving direction. Tools are for heavy-duty service and may be used to run on or off nuts, studs and bolts in tight spaces. They are obtainable in square or hexagon spindles and square, hexagon or Morse Taper shanks. Special models may be designed to meet individual requirements. *Invincible Tool Co, Empire Bldg, Pittsburgh 22, Pa.*

Aluminum-Bronze Electrode

WILSON NO. 200 coated high-tensile-bronze electrode, designed for shielded-arc welding, can also be used as a filler rod in carbon-arc welding. It welds most bronzes, malleable and cast iron or steel. Wilson No. 200 is also for welding dissimilar metals, such as cast iron to brass, steel to malleable iron, or the joining of any

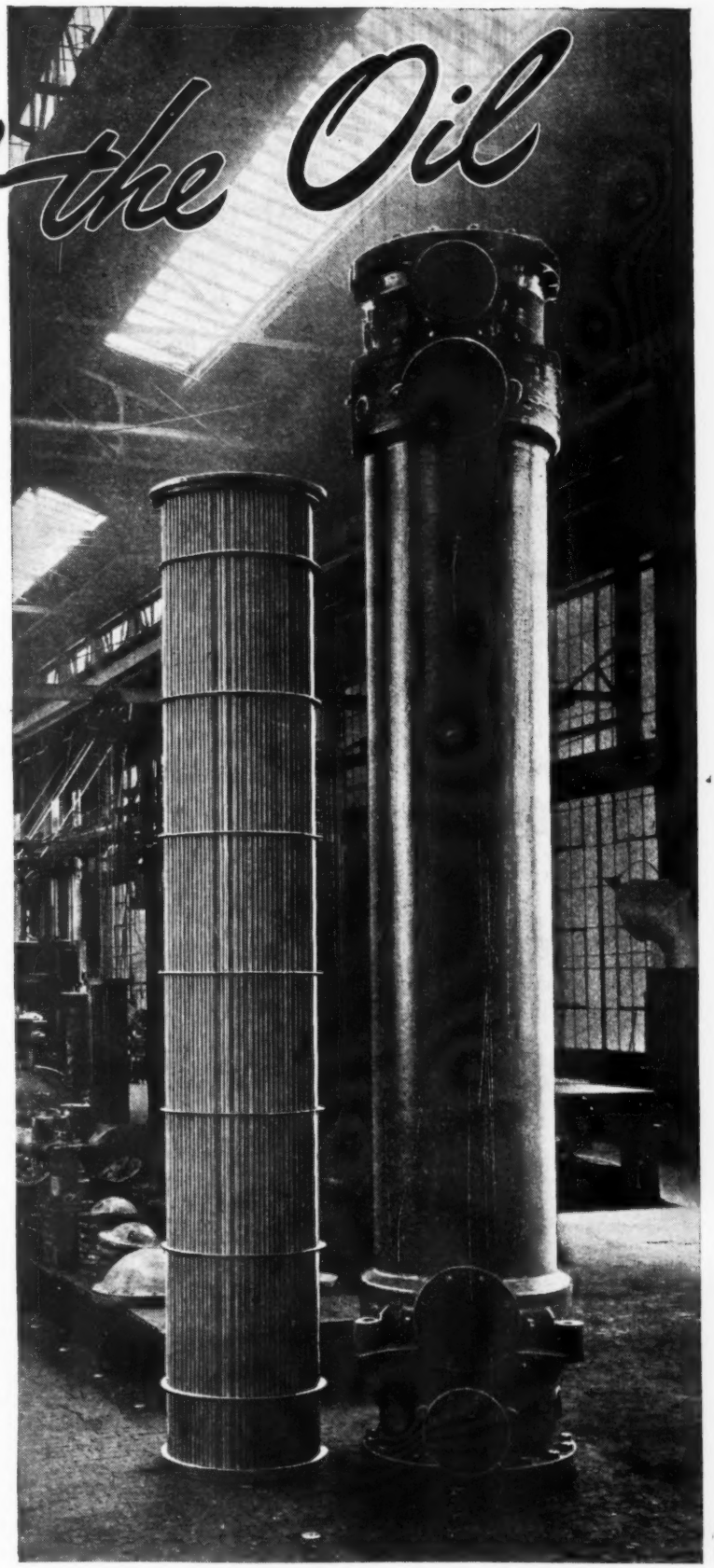
To Cool the Oil

FOR 3600 HP DIESEL ENGINES

Measuring more than fourteen feet overall, and 26 inches in diameter, this main lube oil cooler made by Schutte & Koerting Company, Philadelphia, is serving one of sixteen 3600 hp Diesel engines which furnish power for a large industrial plant.

The entire tube bundle, including tubes, tube sheets and baffles, is of Anaconda Muntz Metal to provide efficient heat transfer.

The wide variety of specialized copper alloys, the engineering experience and research facilities provided to so many manufacturers and users of heat transfer equipment is at your service. Publication B-2 lists Anaconda Condenser Tube Alloys, describes their manufacturing processes, compositions and fields of application. We'll be glad to send you a copy. 44105



Main Lubricating Oil Cooler for 3600 hp Diesel engine, built by Schutte & Koerting Company. Entire tube bundle is made of Anaconda Muntz Metal.

ANACONDA

Anaconda Heat Exchanger Tubes

THE AMERICAN BRASS COMPANY—General Offices: Waterbury 88, Connecticut

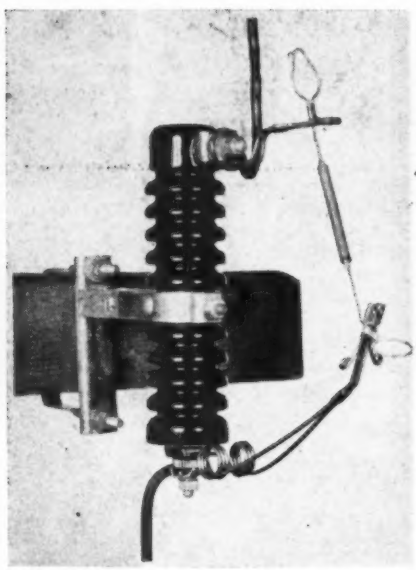
Subsidiary of Anaconda Copper Mining Company—In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

(Continued from page 124)

two metals which are weldable with aluminum-bronze. Sizes from ⅛ to $\frac{5}{16}$ in. in 14-in. lengths, and ¼ in. in 18-in. lengths are standard items. Sizes from $\frac{3}{16}$ to ½ in. in 18-in. lengths may be procured on special order. *Wilson Welder & Metals Co, 60 E 42nd St, New York 17, N. Y.*

Dial Thermometer

PHENOLIC CASE DIAL THERMOMETER, 4½ in., withstands severe operating conditions. Instrument is for installations requiring long tube length between bulb and instrument. This 53K series mercury-actuated dial thermometer may be had with a wide variety of standard temperature-sensitive bulb constructions and in a wide size range. *Taylor Instrument Companies, Rochester 1, N. Y.*

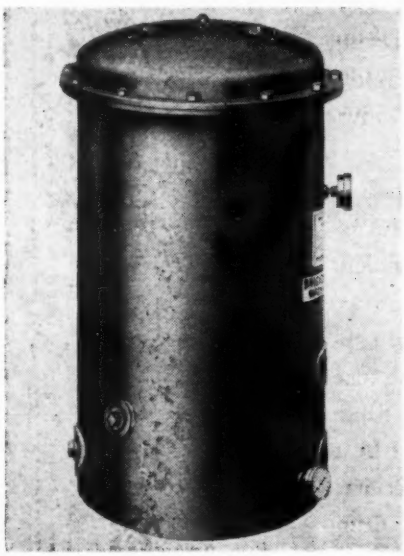


Fuse Cutouts

SLIP-OPEN FUSE CUTOUTS provide overcurrent protection by a fuse link, but without conventional hinged fuseholder tube. Cutouts, rated 50 amp, 7500/12,500 and 15,000 v, have clamp line terminals, wet-process solid porcelain insulator and spring contact arms. Fuse is supported in tension between spring contacts. When fuse link blows, spring tension of contacts widely separates severed ends of link, thereby giving visual indication of blown fuse from ground at any angle. Switch stick quickly re-fuses cutout. *General Electric Co, Schenectady, N. Y.*

Area Flowmeter

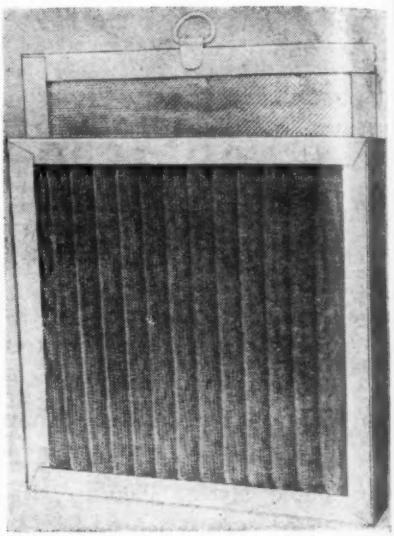
R-100 ROTAMETERS are of indicating area meter design, covering sizes from ⅛ to 3 in., with both free and guided floats. Floats may be viscosity or density compensated. Metering tubes are said to be of extra-heavy-wall Pyrex borosilicate glass formed on mandrels, annealed, polariscope inspected and check-gaged by precision ball test. *Cochrane Corp, 17th St at Allegheny Ave, Philadelphia 32, Pa.*



Fuel-Oil Filters

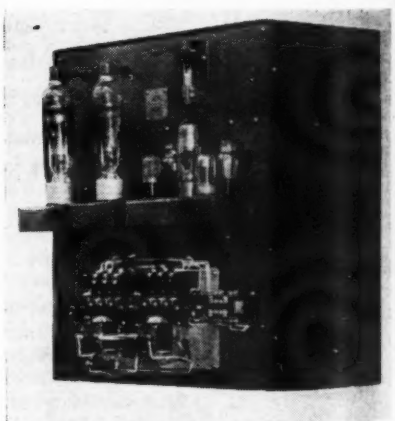
IMPROVED STANDARD LINE of round-tank fuel oil filters for diesel engines broadens application of Briggs fuel oil clarifiers so that flow capacities range up to 500 gph. For small high-speed diesel engines where pressures sometimes run above 50 psi, clarifier is designed for a maximum working pressure of 100 psi and is hydrostatically tested at 150 psi. For large heavy-duty diesels where pressure is usually between 15 and 25 psi, clarifier is designed for a maximum working pressure of 40 psi and hydrostatically tested at 60 psi. Pressure drop across refills ranges from 0 to 5 psi on all models.

Covers and cover gaskets are interchangeable in the various sizes. Spare gaskets may be ordered with bolt holes already punched. A gage in upper compartment and another in lower compartment of tank registers pressure differential across refill cartridges. A glance tells operator the exact pressure differential and when to change refills. Manufacturer states that improvements have been made in refill holding assembly to assure a perfect seal at both ends of refill cartridge. *Briggs Clarifier Co, 1339 Wisconsin Ave, NW, Washington, D.C.*



Oil Separator Filter

NEW FILTER, properly installed in a ventilating system, removes oil, kerosene, etc, entrained in air. It does not, however, remove oil, smoke or liquids in a true vaporous state. R-56B oil-separator panel consists of a permanent, viscous impingement filter that removes dirt and dust from air and a removable oil-collecting media that traps remaining liquid particles. *Air-Maze Corp, Cleveland 5, Ohio.*



Electronic Motor Control

AN ELECTRONIC ADJUSTABLE-SPEED drive, sizes 1 to 7.5 hp, operates from an ac polyphase power system to provide speed ranges of 20 to 1, and higher for some applications. It consists of a combination electronic control-and-rectifying unit that supplies power to a dc motor. Grouped in one part of the control are the excitation tube for motor

(Continued on page 188)

Piping systems...any kind...for any service
CRANE equips them fully

ONE SOURCE OF SUPPLY... ONE RESPONSIBILITY FOR ALL MATERIALS

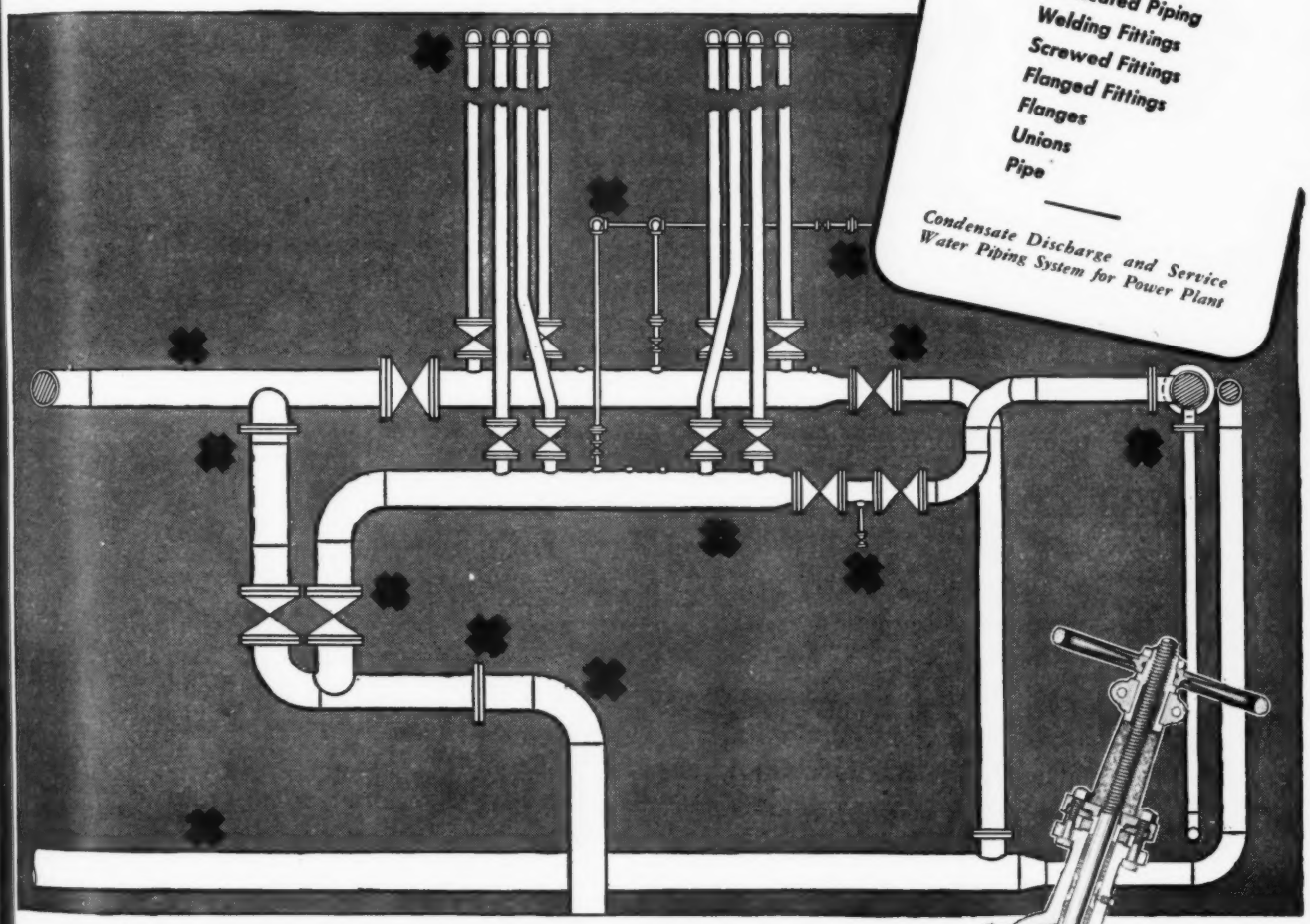
No matter what your needs in piping equipment—whether for power or processing systems—all the benefits of single source supply can be yours. Pipe, fabricated piping, valves, fittings—all these essential materials down to the last accessory are available from Crane. You choose exactly what you need—from the world's largest selection for all pressure-temperature classes.

Ordering—keeping of parts stocks—maintenance—such operations are simplified if you Crane equip. More important, one responsibility for quality and craftsmanship of piping materials is a primary aid to good installation. Crane meets that responsibility with a record of 89 years' leadership in the piping equipment field. CRANE CO., General Offices: 836 S. Michigan Ave., Chicago 5, Ill.

Equipped by Crane 100%

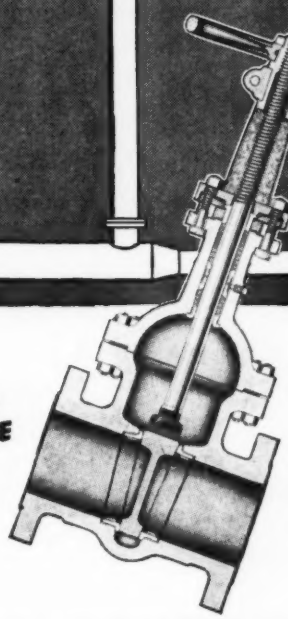
- Gate Valves
- Globe Valves
- Fabricated Piping
- Welding Fittings
- Screwed Fittings
- Flanged Fittings
- Flanges
- Unions
- Pipe

Condensate Discharge and Service Water Piping System for Power Plant



ONE STANDARD OF QUALITY

Equipping completely with Crane materials insures one high standard of quality in every part of piping systems. That dependable quality is exemplified in Crane Steel Gate Valves: Finest flow behavior results from their straight-through ports. Severest line stresses are overcome with rugged bodies. Smooth operation is maintained by a ball-joint type stuffing box gland, strong tee-head disc-stem connection, and ample stem bearings. Positive seating is aided by extra long guide ribs.



CAST STEEL WEDGE GATE VALVES

CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

The price of progress is trouble . . . If any two men in this office agree continuously, one of them is unnecessary.

The "No" Man . . .

An old parable explains the difference between a diplomat and a lady this way: If a diplomat says "Yes," he means "Perhaps"; and if he says "Perhaps," he means "No." But if he says "No," he's no diplomat. If a lady says "No," she means "Perhaps"; if she says "Perhaps," she means "Yes." But if she says "Yes," she's no lady.

As his company's top power authority, any power engineer is depended upon to follow a middle course—to know when a "yes" or a "no" is to the company's advantage. An executive may have preferences for a certain make or type of power-service equipment—but rarely will he back his preference over the engineer's experience and judgment. If he does, he makes the engineer just a "yes" man—and may as well have a nincompoop in the job.

But, by the same token, it is extremely easy for an engineer to become a "no" man—getting the habit of closing his ears alike to honeyed sales talks and really important developments. Saying "no" is always an easy solution—it saves thinking and planning and the initial troubles inevitable in doing something new.

It's the engineer's responsibility to stay fairly in the middle, saying "yes" when he sees worthwhile possibilities and using his tremendous veto power only when it is deserved. He dare not be a "yes" man for somebody else—and can't afford to be a "no" man if he wants to keep on growing.

George Edwards
Engineer

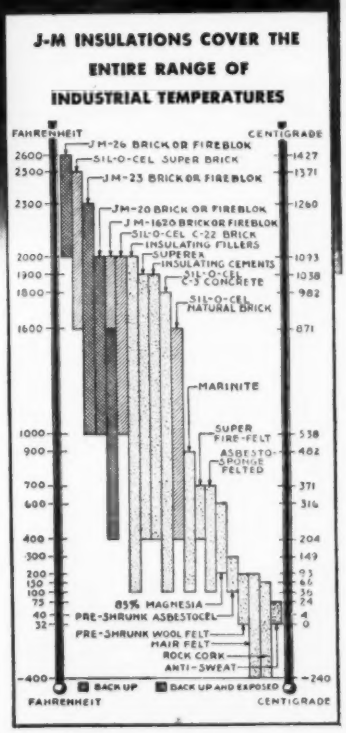
The Taming of the B.t.u.

THAT'S NOT FLAME you see coming from the electric induction furnace in the picture above. It's heat. White heat, at 3200° F. This is one of a score of tests performed in the Johns-Manville Research Laboratory—a part of J-M's continuing effort to control more completely the flow of heat.

During the past 27 years, history-making progress in developing more efficient insulation has been made in this laboratory—the largest of its kind in the world. Here, some of the most baffling problems in heat-flow and its measurement have been solved. Here, too, J-M Scientists have devised a number of insulations, each designed to do a certain job . . . from minus 400° to 2600° F.

This unequaled assortment of insulating materials is available to you. And trained Johns-Manville Insulation specialists, plus the facilities of the J-M Research Laboratory, are available to help you with your particular heat or cold insulation problems.

For the full story on J-M Insulations and Refractory Products for the power plant, write Johns-Manville, 22 East 40th Street, New York 16, New York.



JOHNS-MANVILLE JM PRODUCTS

Johns-Manville INDUSTRIAL INSULATIONS

FOR EVERY TEMPERATURE . . . FOR EVERY SERVICE

POWER NEWS

BUSINESS ITEMS AND APPOINTMENTS • WASHINGTON NOTES

CONVENTIONS • WAR AND POSTWAR POINTERS • COAL MISCELLANY

National Fuel Efficiency Program in High Gear

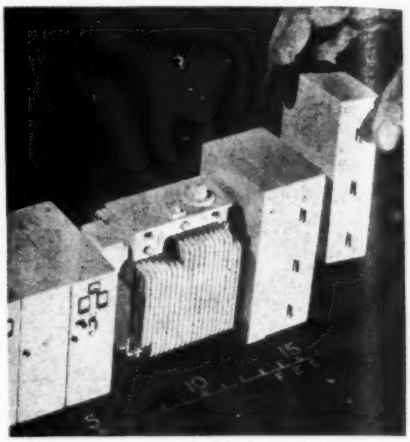
Number of coordinators, who will direct a staff of approximately 5000 regional engineers—including some of the country's foremost fuel experts—is now 76 and is expected to reach 300. Serving without compensation, these thousands of volunteers, mostly from industry, are helping the National-Fuel Efficiency Council and the Bureau of Mines achieve their goal: a 29-million-ton reduction in the annual commercial and industrial consumption of coal and proportionate savings in other fuels.

Many coordinators have sent their staffs of regional engineers into action, calling at industrial and commercial plants in their areas to analyze fuel-utilization conditions, to offer suggestions for greater operating efficiency, and to distribute special technical literature prepared by experts in the operation and maintenance of fuel-burning equipment.

Additional fuel economies, which may yield even greater results, will be sought outside the boiler rooms by promoting use of insulation and conservation of electricity, steam, hot water, compressed air, and other sources of heat and energy stemming from fuel.

Reports throughout the country indicate that plant managers are welcoming not only the expert technical advice but the opportunity to help solve serious wartime fuel shortages.

o o o



New scale models of unit substation equipment will soon help executives and plant engineers work out perplexing power distribution problems, enabling them to "build" unit substations right on their desks. Accurately scaled ½ in. to 1 ft and exactly like dozens of units in substation layouts, the models were created by Allis-Chalmers to eliminate complexity and drudgery from planning power distribution systems. Field engineers will carry the models in sets, which will also include single-line diagrams of possible substation arrangements, layout sheets scaled to the models' dimensions and a check list of other engineering data.

o o o

At Grand Coulee Dam's huge power plant, operating engineers claim that, with a gross output of more than 621,000,000-kwhr during March, the mammoth installation sets a new world record for electrical production by a single plant in a month's time.

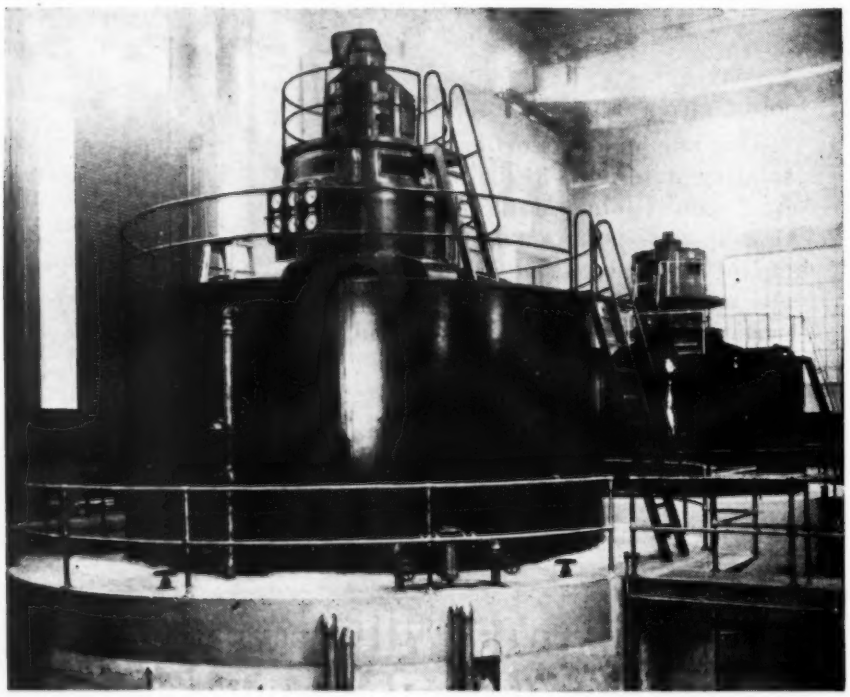
Almost the entire production was transmitted to Pacific Northwest aluminum plants and other war industries. Two 75,000-kw units transferred from Shasta dam to Grand Coulee in 1943 expedite delivery of additional war power. Six other units, each rated at 108,000-kw, are the world's largest hydroelectric generators.

o o o

Additional power - generating - equipment authorizations will continue indefinitely on the same basis as in recent

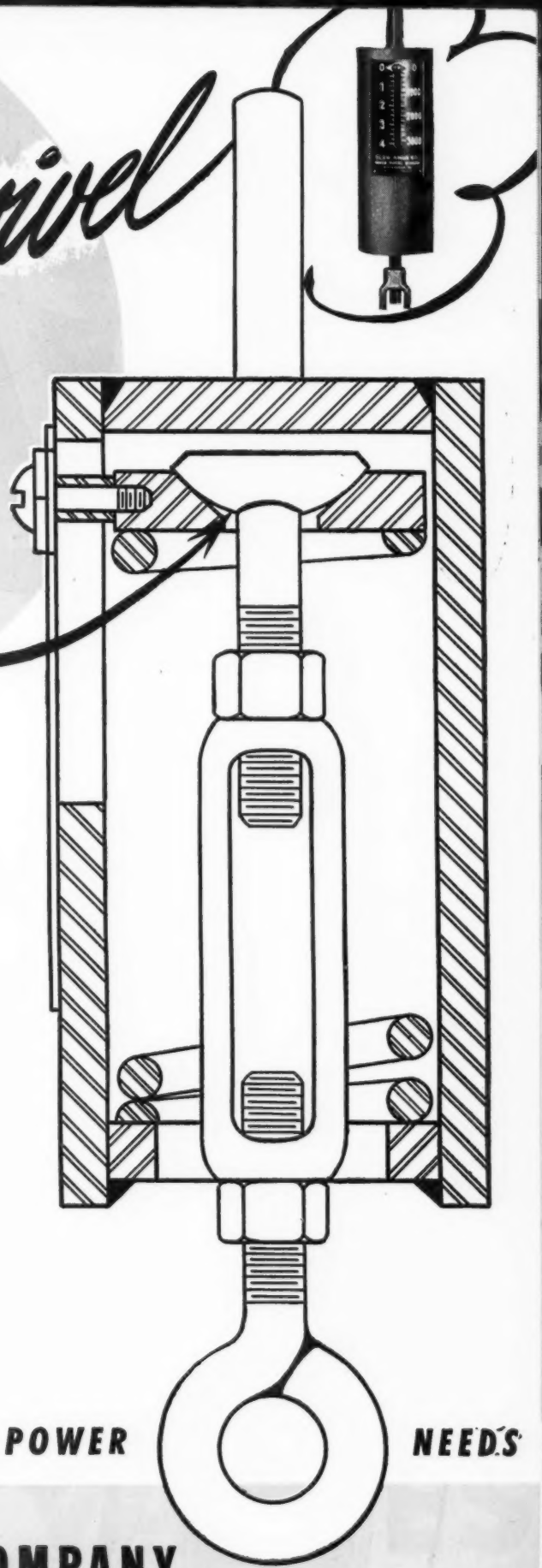
(*Continued on page* 162)

BRAZIL GETS BIG WATERWHEEL GENERATOR



Believed to be the largest vertical waterwheel generator for this speed ever built in the United States, this Westinghouse machine, rated at 40,250 kva, 600 rpm, 85% pf, is now helping supply the rapidly expanding Brazilian war production. Contracts for another machine of equal rating were signed recently

Exclusive Internal Swivel action



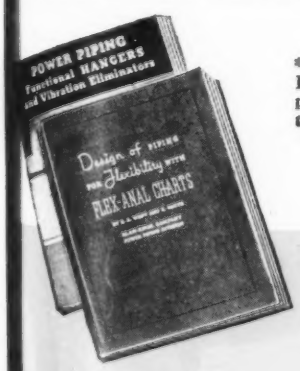
POWER PIPING
FUNCTIONAL HANGERS

SCALE —Actual load indicated in Lbs. at all times.

SPRINGS —Totally enclosed and guided.

ROD —Pivotal action, swings freely with complete lateral and longitudinal movement, permitting short headroom installation. This internal swivel action is a patented feature.

SHORT HEADROOM —Turnbuckle adjustment *11⅛" minimum for any load.



*FLEX-ANAL CHARTS and HANGER BULLETIN 1863 save time in engineering manpower. Copies of these books can be obtained through a request on your business letterhead.

FIT ALL MARINE & POWER NEEDS

BLAW-KNOX COMPANY
POWER PIPING DIVISION
1525 PENNSYLVANIA AVE., PITTSBURGH, PA.

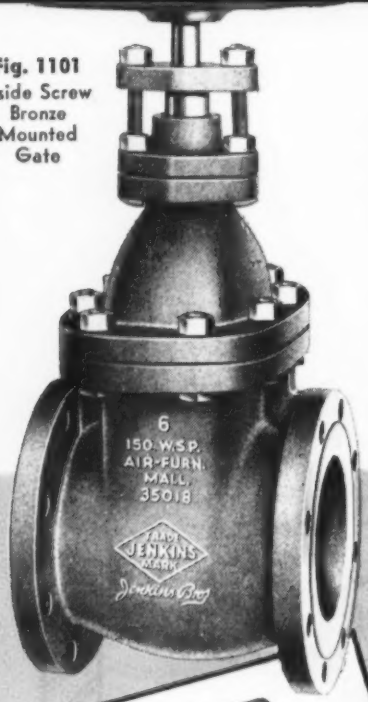


Fig. 1101
Inside Screw
Bronze
Mounted
Gate

WHAT OTHER VALVE OFFERS *Toughness* LIKE THIS AT SUCH LOW COST?

JENKINS *AIR FURNACE*

The kind of toughness you'd expect only from steel is now available in Jenkins Air Furnace Malleable Iron Valves!

This completely new class of Jenkins Valves was developed for some of the most strenuous war services – to withstand severe strains, heavy blows, – even the shock of nearby explosions. They are made from the same tough metal that has been battle-proved daily in U. S. war equipment.

Though these valves compare favorably with carbon steel in strength and impact resistance, they are priced substantially less. You save in first cost – and again later when repair and replacement costs

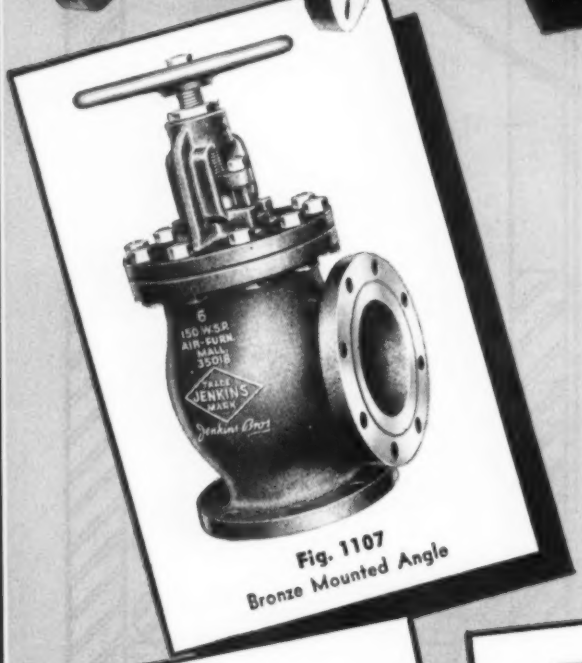


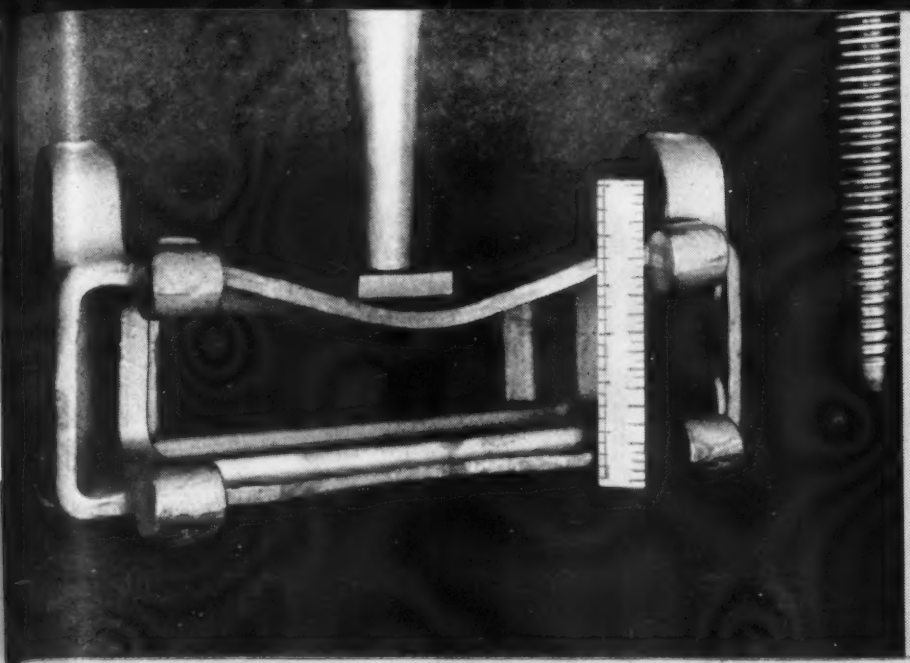
Fig. 1107
Bronze Mounted Angle

Fig. 1103 O.S.&Y.
Bronze Mounted Gate

Fig. 1105
Bronze Mounted Globe

Write for Bulletin No. 192 and specification sheets, which are sized to fit handily into your Jenkins Catalog. They describe the complete new line – the patterns illustrated here, sizes 2" to 6". Write to Jenkins Bros., 80 White St., New York 13, N.Y.

Fig. 1109 Bronze Mounted Swing Check



PRESSURE TEST proves Malleable Iron Castings can take EXTREME OVERLOAD without Fracture

This test was made by a large manufacturer using malleable castings in war-vital equipment. It shows that malleable iron has the strength to withstand terrific pressure without fracturing – just as it withstands sudden shocks.

This dependable toughness in a *valve* will save you trouble where expansion, contraction and similar stresses, are unusually severe.

MALLEABLE IRON VALVES

are lower, and fewer service interruptions waste production time.

Next time you order valves for use *where steam pressure does not exceed 150 pounds, and where temperature is not above 450°F.*, check service conditions closely. If valves will be subject to destructive shocks and strains, if corrosive conditions are bad, specify Jenkins Air Furnace Malleable Iron Valves . . . and get enduring toughness at a surprisingly low cost!

Jenkins Bros., 80 White Street, New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago. Jenkins Bros., Ltd., Montreal; London.

High Corrosion Resistance – Air Furnace Malleable Iron Valves resist corrosion *better* than carbon steel or cast iron valves. This advantage, combined with high impact resistance, specially qualifies these new valves for many marine, petroleum, mining, chemical and other industrial services.

Meet U. S. Standards – Jenkins Air Furnace Malleable Iron Valves meet the standards of the U. S. Maritime Commission, and the Bureau of Marine Inspection and Navigation, U. S. Coast Guard.

Don't confuse *Air Furnace* Malleable with other types of malleable iron. Top-rated grade is Air Furnace Standard Specification ASTM-47-33, Grade No. 35018 . . . used by Jenkins.

ONLY AIR FURNACE MALLEABLE MEASURES UP TO THE SPECIFICATIONS SHOWN IN THIS CHART

COMPARE	TENSILE STRENGTH	SHOCK RESISTANCE		TEMPERATURE LIMIT	CORROSION RESISTANCE (Relative)	VALVE COST (Relative)
		YIELD POINT	ELONGATION IN 2 INCHES			
ASTM 126-30 CAST IRON	34,000 LBS. PER SQ. IN.	0	0	TO 450°F		
ASTM 47-33 AIR FURN. MALL. GRADE 35018	53,000 LBS. PER SQ. IN.	35,000 LBS. PER SQ. IN.	18%	TO 450°F		
ASTM 95-36 CARBON STEEL	70,000 LBS. PER SQ. IN.	36,000 LBS. PER SQ. IN.	22%	TO 750°F		

JENKINS VALVES

BRONZE ★ IRON ★ STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE

SOLD THROUGH RELIABLE INDUSTRIAL DISTRIBUTORS EVERYWHERE

Number 143

Transformer Maintenance CHECK CHART

Handy check list for frequency of inspection and maintenance operations on all types of transformers and their associated auxiliary equipment

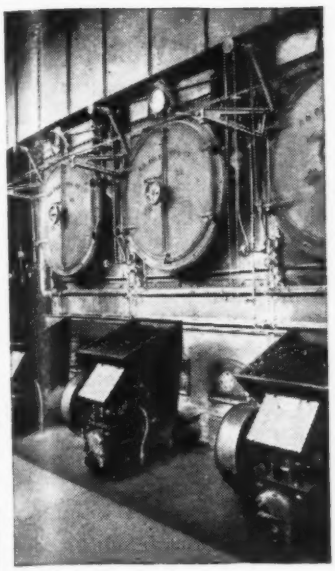
TRANSFORMER MAINTENANCE		Hourly[1]	Daily	Weekly	Monthly	Quarterly	½-year	Yearly	2-year	3-year	5-year	Low-oil test
All oil-insulated transformers	Oil level	●										
	Ambient temperature	●										
	Oil temperature	●										
	Coil temperature	●										
	Load (amperes)	●										
	Voltage	●										
	Relays				●							
	Lightning arrester, etc.					●						
	Ground resistance					●						
Open type[2]	Oil tests					●						
	Oil filtering								●			●
	Inspection (under cover)				A		●					
	Inspection (above core)								●			
	Over-all inspection										●	
	Breathing					●						
Conservator and gas seal	Relief diaphragm	●										
	Oil tests					●						
	Oil filtering											●
	Inspection (above core)										●	
	Over-all inspection										B	
Water cooled	In-out water temperatures			●								
	In-out water flow						●					
Forced oil	In-out oil temperatures			●								
	Pump glands	●										
	Cooler screens			●								

TRANSFORMER MAINTENANCE		Hourly[1]	Daily	Weekly	Monthly	Quarterly	½-year	Yearly	2-year	3-year	5-year	Low-oil test
Oap[3]	Fan control				●							
	Motor and fan				●							
Air-blast indoor	In-out air-blast temperatures	●										
	Compressed air cleaning			●								
Gas-seal equipment	Gas pressure (Hg gage)		●									
	Oxygen content			C			●					
	Cu ft gas in cylinder		●									
	Mercury relief valve					●						
	Pressure-alarm circuit					●						
	Gas regulator					●						
Load-ratio-control apparatus	Contactors							●				
	Non-arcing ratio adjusters										●	
	Arcing ratio adjusters							●				
	Stuffing boxes							●				
	Oil tests					●						
	Relief diaphragm	●										
	Mechanism							●				
	Ventilators							●				
	Automatic control				●							

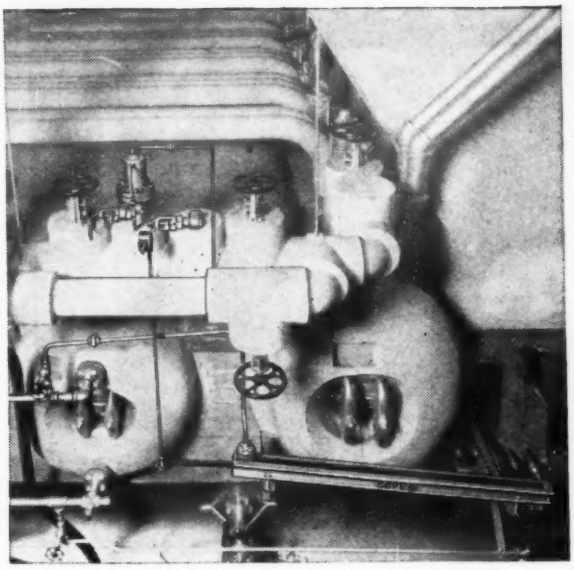
[1] *Items to be checked on regular rounds, assumed about hourly*
[2] *Without conservator or gas seal*
[3] *Oil-insulated with external cooling fans for radiators*

A *Initial operation*
B *Can be 7 to 10 years*
C *First month of operation*

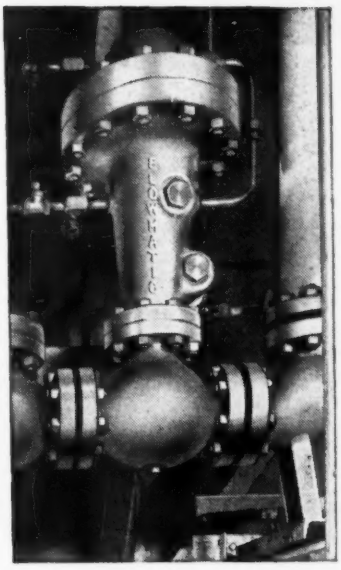
Courtesy, General Electric Co



Atlanta Ice & Bottling Co., Atlanta, Georgia. 3 Copes Type OT Regulators installed on HRT Boilers operating at 100 pounds pressure.



Industrial Plant. One of two feed lines to 650-pound pressure C-E Boiler handling a peak of 150,000 pounds per hour, controlled by a Copes Type BI Regulator and Type 3-S-2 Differential Valve.



Eddy Paper Corp., White Pigeon, Mich. Direct-operated Copes Flowmatic Regulator Valve on 550-pound Badenhausen Boiler.

There's a COPES *Feed Water Regulator*
FOR EVERY BOILER REQUIREMENT

SMALL BOILERS?

For HRT, Scotch Marine, and other small boilers, the Copes Type OT Regulator is ideal. Extremely simple, easy to install, compact, direct operated.

Sizes 3/4" to 2", 250 and 300 lb. stds.

WATER TUBE BOILERS?

For the conventional water tube boiler subject to ordinary loads, the Copes Type BI Regulator is universally the best known simple level regulator. Fully automatic, thoroughly reliable, smooth acting. Direct or relay operated. Sizes 3/4" to 8" all pressure stds.

SENSITIVE BOILERS?

For boilers subject to severe load fluctuations or those sensitive to shrink and swell, the Copes Flowmatic is the correct answer. This steam-flow water-level control is the most rapidly accepted development of recent years. Direct or relay operated.

Sizes 1½" to 8", all pressure stds.

TO be most effective, your feed water regulators must be suited to the particular requirements of the boilers they serve. Boiler design, firing methods, operating procedures, load demands, and space limitations all require consideration.

Whatever your boiler plant characteristics, you will find a Copes Feed Water Regulator that is "made to order." For we manufacture simple level regulators and steam-flow water-level controls in several types, both direct operated and remote relay operated. In addition, every control valve is provided with plunger and ports designed for the existing pressures, temperatures, and rates of flow.

Thus a Copes assures you of individualized feed water control that is in complete agreement with the application. That's one reason why there are over 65,000 Copes Feed Water Regulators in service. For other sound reasons, write for General Catalog No. 12-41.

NORTHERN EQUIPMENT COMPANY

741 Grove Drive, Erie, Pennsylvania

FEED WATER REGULATORS • LIQUID LEVEL CONTROLS • PUMP GOVERNORS
DIFFERENTIAL VALVES • REDUCING VALVES AND DESUPERHEATERS

Branch Plants in Canada, England *Representatives Everywhere*

☆ *For* **SAFETY** *and* **ECONOMY** *Specify*

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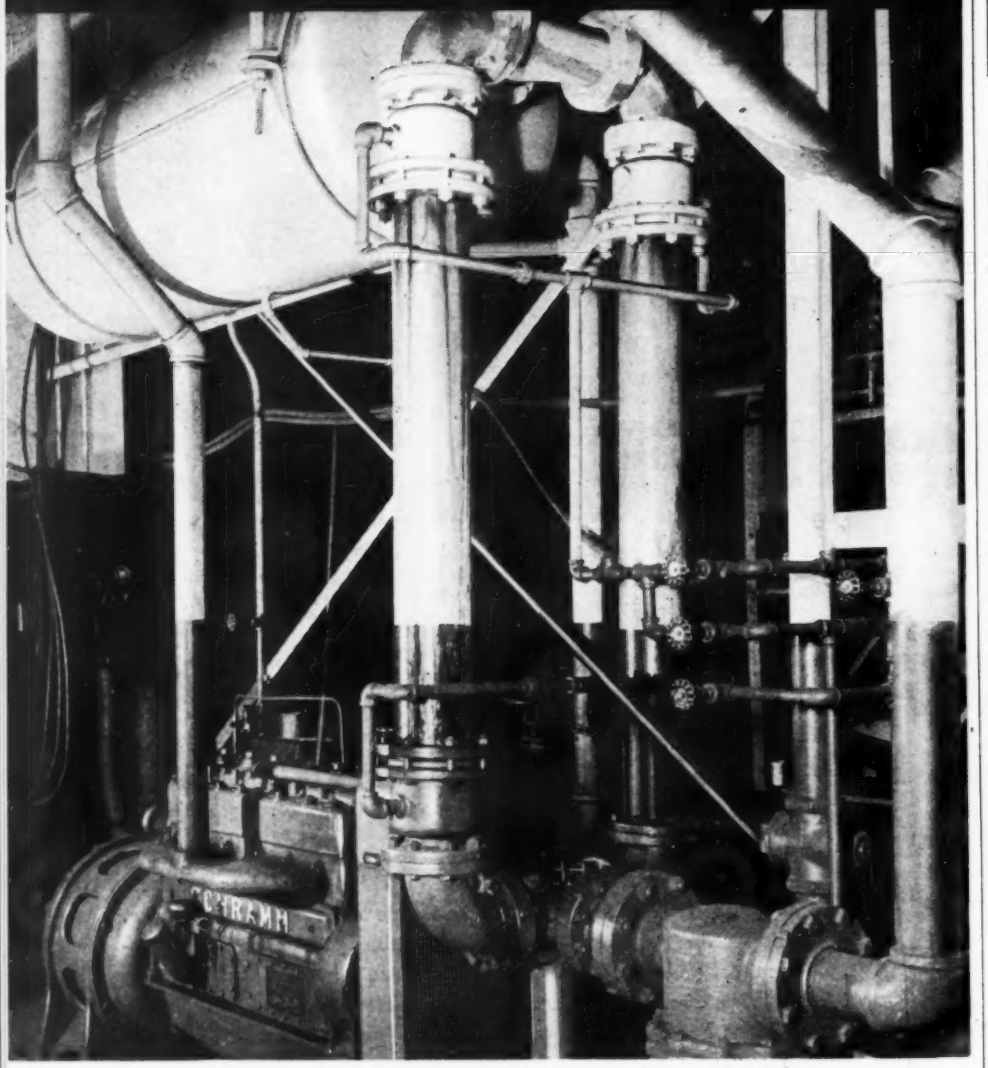
COMPACTNESS



.....You get it in every

SCHRAMM AIR COMPRESSOR

The illustrated Schramm air compressor fits in a minimum amount of floor space—reducing headroom and floor space requirements. All Schramm Compressors are lightweight, compact, free of vibration!

Schramm stationary units, for use in industrial and power plants, are intended for heavy, continuous service. No elaborate foundation needed, and can be installed and used wherever motor current is available.

100% watercooled — to prevent overheating in summer, freezing in winter — is an important feature. Standard equipment includes: compressor with direct coupled motor; mounted on formal steel base, with air cleaners (2), discharge flange, unloader pilot valve and intake valve unloaders and water connections. Can be furnished with flywheel and extended shaft, for V Belt drive, tank mounted, and any other requirement. For detailed data write at once for Bulletin IND — 44

SCHRAMM INC. THE COMPRESSOR PEOPLE WEST CHESTER PENNSYLVANIA

Electric Welding

(*Continued from page 67*)

A small amount of work hardening of the stainless 18-8 is shown by a Brinell hardness, of approximately 200 to 210, obtained with a portable Brinell set using a 5-mm ball and 750-kg pressure. Three sizes, 5/32, 1/8 and 3/32 in. 18-8 rods were applied with reverse polarity, using 90 to 95 amp and 27 to 30 v. The 3/32-in. rod was used mainly for patching low areas during grinding operations. The table, on page 67, shows amount of rod.

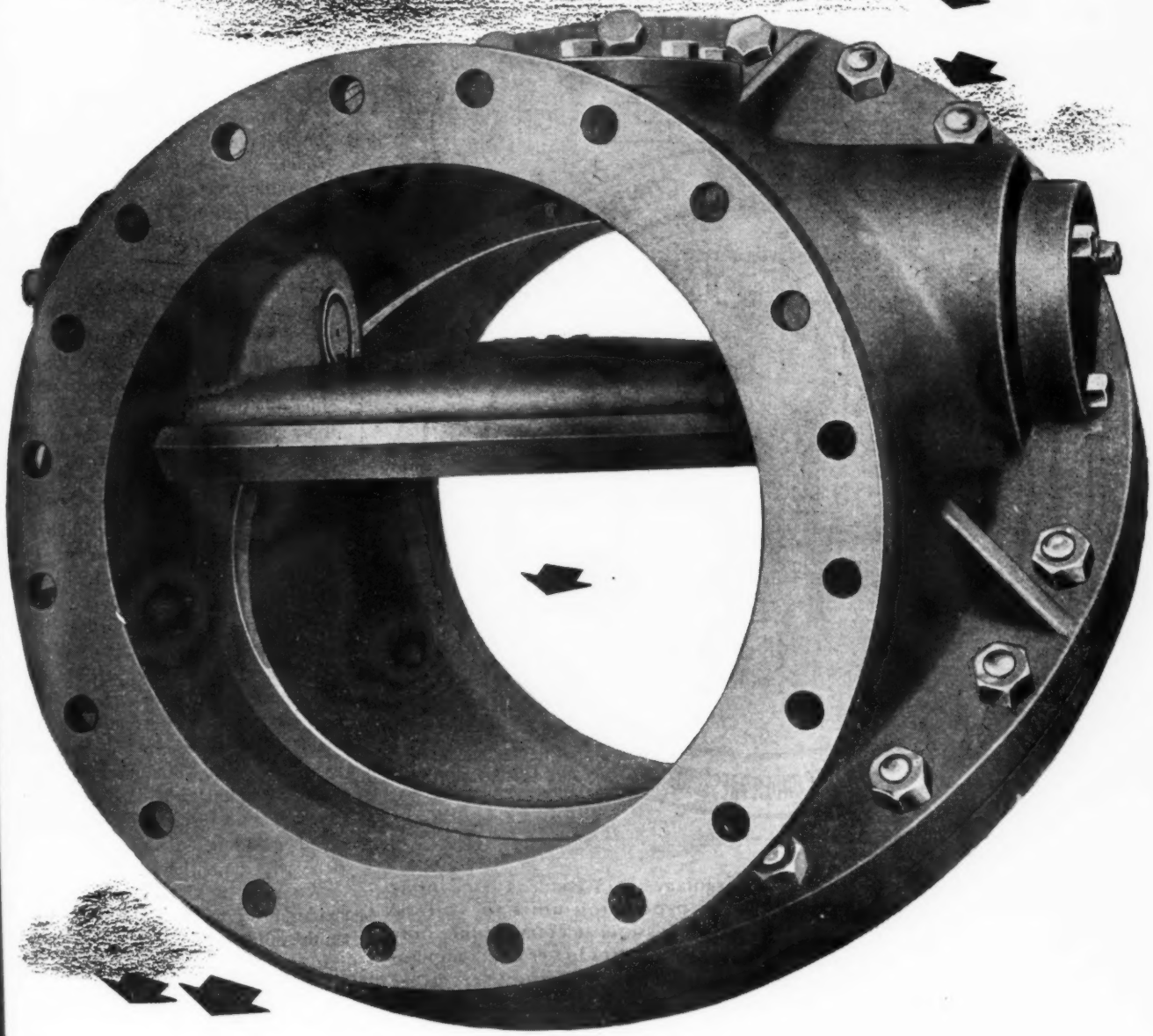
Units N-2, N-3 and N-4 were repaired with 5/32- 1/8- and 3/16-in. mild-steel rod, having approximately 0.14 carbon content, 70,000- to 80,000-psi tensile strength, and 20% elongation in 2 in. This rod was applied with straight polarity, 150 amp and 25 to 30 v, using the same method as on N-1. Where pitting was deep, seven welding beads were required to build up some vanes to original contour. Brinell hardness was approximately 145-160, using a 5-mm ball and 750-kg pressure, about the same as the parent metal.

Low-Chromium Rod

On vane 15, unit N-4, a special low-chromium rod, having 4 to 6% chromium, a small amount of vanadium and molybdenum, and 0.10 to 0.18 carbon was used. It has a tensile strength of 100,000 psi and 12 to 18% elongation in 2 in. This rod, difficult to apply, required longer welding time than stainless- and mild-steel rods. Great care was taken to puddle the metal to eliminate gas pockets or slag inclusions, but effect of air hardening was noticed, as the Brinell hardness was 205 and the surface was more difficult to grind than 18-8 stainless. The rod was applied with 150 amp and approximately 30 v and reverse polarity. Pitting resistance of this vane is no greater than for mild steel. The low-chromium surface did not give a non-corroding finish and after two week's operation vane 15 could not be distinguished from those repaired with mild steel.

Some cracks developed on the runner in the upper or lower fillet near the trailing edge of the vanes and in the band or lower shroud. These cracks were given considerable study and all runners tested with the Magnaflux method. To facilitate these tests 12 turns of 00 extra-flexible cable were wrapped around two vanes at a time and supplied with a current of 100 amp. After the tests, current was reserved to demag-

AIRFOIL DESIGN means



CUSHIONED CLOSING

No slamming, no hammering, no surging on lines. Reduction of flow starts the disc closing until it comes down silently to a drop-tight seat.

REDUCED HEAD LOSS over conventional type checks, by 60 to 80%. Hinge pinned disc "rides" the flow with minimum resistance.

LONGER LIFE

. . . for both check valves and pipe lines!

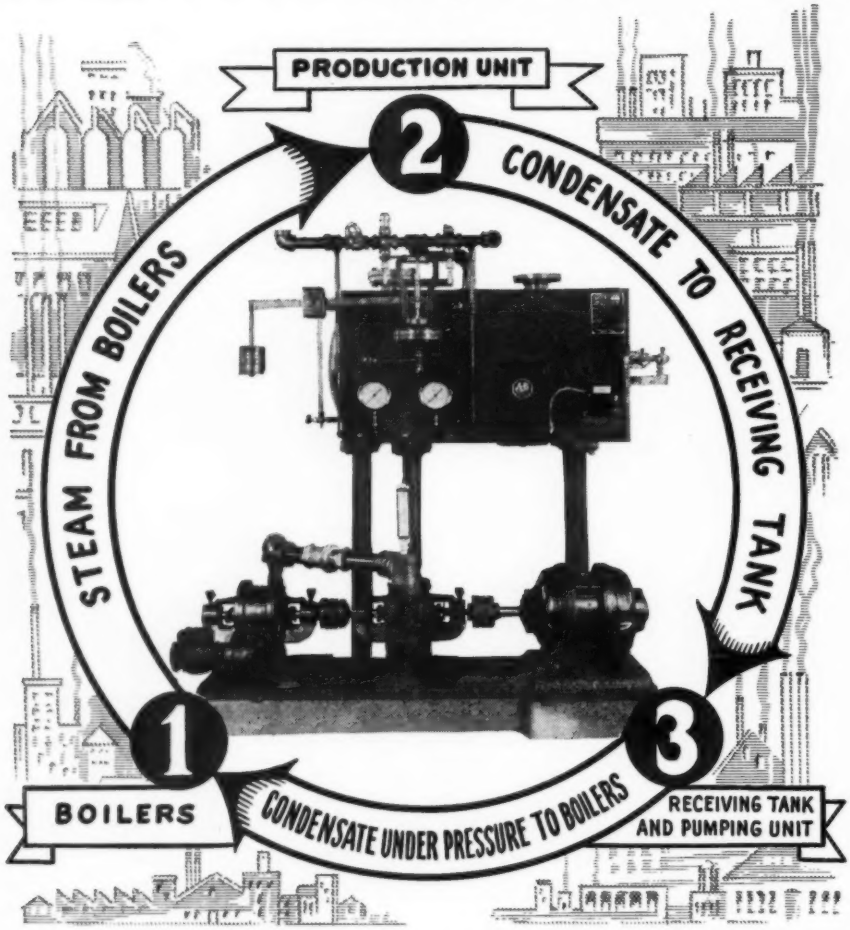
WRITE US for the 12-page booklet giving full engineering data, test results and installation information on Chapman's Non-Slam Check Valves. The Chapman Valve Manufacturing Co., Indian Orchard, Mass.

CHAPMAN NON-SLAM CUSHIONED CLOSING CHECK VALVES

Equally efficient on horizontal or vertical installations on water, steam, oil, gas and air lines

INCREASED PRODUCTION —DECREASED COSTS

For Industries Using Process Steam



The Stickle Differential Drainage and Boiler Return System will serve effectively any type of industry using large quantities of steam at medium or high pressures for processing operations. Canning plants, laundries, milk drying plants, sand drying plants, and paper board mills are examples of the type of plants where it has proved itself for reducing costs and increasing efficiency.

This system affords these definite advantages: (1) Returns condensate from processing units to boilers, under pressure, at a temperature only 15 to 20 degrees lower than temperature of steam at operating pressure—saving fuel and increasing boiler capacity. (2) Supplies positive and correct drainage—assuring maximum production of units. (3) Eliminates high velocities and reduces scale—decreasing maintenance costs. Bulletin No. 250 supplies complete data.

OTHER STICKLE BULLETINS: Nos. 115, 315, 515—Stickle Open Float Steam Traps. Nos. 235 and 435—Stickle Regulating and Reducing Valves. No. 117—Stickle Open Coil Feed Water Heaters and Purifiers.

Stickle

STEAM SPECIALTIES COMPANY

2265 VALLEY AVENUE • INDIANAPOLIS, INDIANA

SPECIALIZING FOR 40 YEARS IN REDUCING THE COST OF STEAM

netize the runners, and prevent shaft currents. These tests revealed cracks in a spare runner, which had not been in service, indicating shrinkage cracks, sand holes and porosity, but these conditions are expected in such massive runners. Runner for unit N-4 had the most defects and shrinkage cracks. The runner also cavitated over a larger area than N-1, N-2 or N-3. Subsequent welding repairs from 1938 to Feb. 1942, have not disclosed any cracks. As a result of the tests and experience gained, specifications for new runners include Magnaflux tests.

After building up the vanes with welded metal, 5-man crews ground the welded areas to conform to the original contour. Horizontal templates insured accurate control of the work. The templates were according to manufacturer's drawings and checked on the spare runner. Variation in contour was considerable on the different vanes so that it was necessary to make the templates to an average vane contour.

Grinding Welded Areas

Multivane and piston grinders were used with flat and recessed wheels. A medium-soft-bakelite wheel with size-14 aluminum oxide grit worked best for grinding the stainless weld metal. They wore faster, but clogged less than others that were tried. Vitrified wheels clogged considerably. Results were best at a speed of about 6000 rpm with a 6-in. wheel. Radial wheels cut faster than recessed ones, but they frequently gouged the metal and were harder to control. As a result, they were used for rough grinding only and finishing was done with cup wheels.

We used a size-24 grit aluminum-oxide hard-grade bakelite-bonded wheel on the mild-steel welded surfaces. Grinding was much faster but the surfaces showed marks of the grinding wheels. However, aluminum-oxide paper disks gave a smooth mirrorlike finish.

In the cost analysis of the labor-distribution table, unit N-1 is high in man-hours per square inch of repaired area. This is because the surface was harder and the difficulties greater in grinding the stainless steel. Also, there is some variation in man-hour requirements, depending on the size of the area to be repaired. The reason is obvious: Costs of installing the platform and other repair equipment remain constant regardless of the area size.

Fig. 10 shows the comparative wearing qualities of mild and stainless steel. The low-chromium surface showed no advantages and was difficult to apply and grind.

Welding repairs produced finished

TUBE-TURN WELDING FITTINGS—RANGE OF SIZES

Type of Fitting	Description	Standard Weight	Extra Strong	Schedule 160	Double Extra Strong	Light Gauge: Nominal Pipe Size	Light Gauge: Iron Pipe Size
Elbows	90° Long Radius	½"-24"	¾"-24"	1"-12"	1"- 8"	4"-24"	3"-12"
Elbows	90° Short Radius	1"-30"	1½"-30"				
Elbows	45° Long Radius	½"-30"	¾"-30"*	1"-12"	1"- 8"	4"-24"	3"-12"
Returns	180° Long Radius	½"-24"	1"-24"	1"-12"	3"- 8"	4"-24"	3"-12"
Returns	180° Short Radius	1"-30"	1½"-30"				
Returns	180° Extra Long Radius	1"-2½"	1"-2½"				
Tees	Straight	¾"-24"	¾"-24"	1"-12"	1"- 8"		
Tees	Reducing Outlet	¾"-24"	¾"-24"	¾"-12"	1"- 8"		
Reducers	Concentric & Eccentric	1x⅜-24x20	1x⅜-24x20		1x⅜-12x10		
Caps		1"24"	1"-24"		1"- 8"		
Stub Ends	Lap Joint	1"24"	1"-24"				
Nipples	Shaped, 90° to Header	1¼"-12"	1¼"-12"				
Nipples	Shaped, 45° to Header	1¼"-12"	1¼"-12"				
Saddles		2"-24" **					
Laterals	Straight	1¼"-24"	1¼"-24"				
Laterals	Reducing-on-Run	1¼"-24"	1¼"-24"				
Crosses	Straight	¾"-24"	¾"-24"				
Rings	Welding	¾"-12"	¾"-12"				
Sleeves	Welding	2"-24" **					

*30" size short radius.

** Since saddles and sleeves are used for external reinforcement only, they do not conform to iron pipe size thicknesses.

SUPER Tube-Turn 45° long radius elbows, 90° long radius elbows, and 180° long radius returns available in both Standard weight and Extra Strong in sizes from ½" to 12".

Tube-Turn welding fittings and flanges conform to applicable ASA and ASTM Standards. For further details please refer to Tube Turns catalog and data book No. 111.

TUBE-TURN FORGED STEEL FLANGES—RANGE OF SIZES

	150 Lb.	300 Lb.	400 Lb.	600 Lb.	900 Lb.	1500 Lb.	2500 Lb.
Welding Neck	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Slip-On	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Lap Joint	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Threaded	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Blind	¼"-24"	¼"- 4"		¼"-3½"			
Socket Type	¾"-24"	¾"-24"	¾"-24"†	¾"-24"	¾"-24"*	¾"-24"	¾"-12"
Reducing-threaded or slip-on		1"-24"	4"-12"	4"-12"	3"-12"	1"-12"	
Orifice—threaded		1"-24"					
Orifice—slip-on		1"-24"	4"-12"	1"-12"	3"-12"	1"-12"	
Orifice—welding neck		1"-24"	1"-10"	1"-10"	1"-10"	1"-10"	
Long Welding Neck	1"-24"	1"-24"	1"-10"				

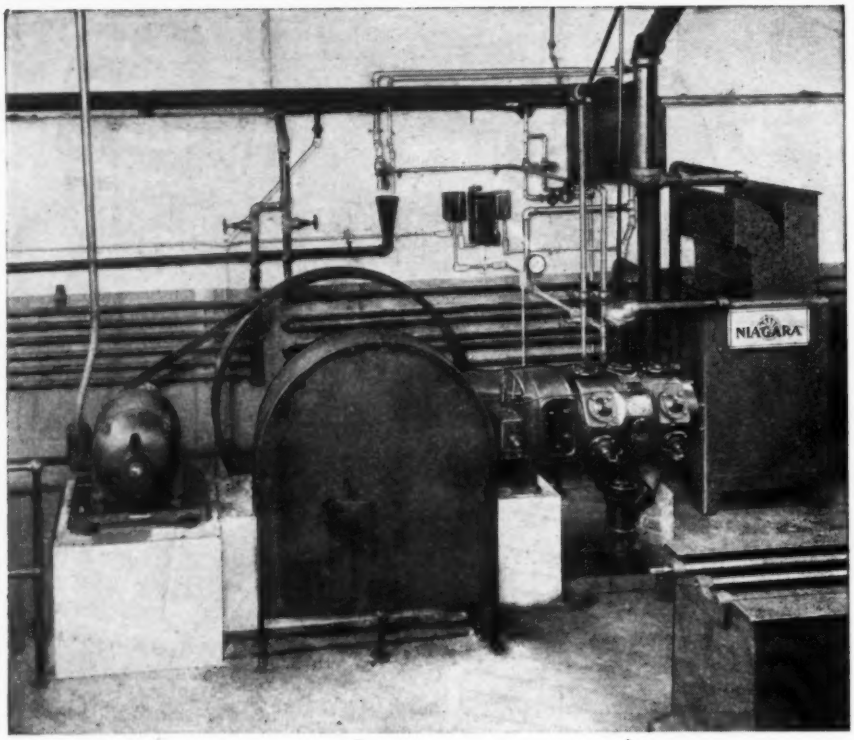
†Dimensions on sizes thru 3½" same as for 600 lb. flanges.
*Dimensions on sizes thru 2½" same as for 1500 lb. flanges.

The FIRST STEAMLESS WELDING FITTINGS AND STILL THE BEST

TUBE-TURN
TRADE MARK

Welding Fittings and Flanges

TUBE TURNS (Inc.) Louisville, 1, Ky. *Branch offices:* New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Houston, Seattle & San Francisco. *Distributors in principal cities.*



PROTECT YOUR AIR TOOLS

● The moisture that is condensed from compressed air is the chief source of trouble with air lines, tools and equipment. It may freeze in the lines; it may rust or damage products exposed to the air stream; it washes the lubricants out of your tools and causes rusting and more rapid wearing out of parts, especially in rotary tools.

To protect this equipment, take the excess moisture out of compressed air by using the NIAGARA *AERO* AFTER-COOLER. It produces lower compressed air temperatures and the resulting air contains only one-half to three-fourths as much moisture as air cooled by conventional methods. Because it is an evaporative cooler, it uses atmospheric air as the cooling medium and pays for itself by saving water costs.

For Complete Information, write to

NIAGARA BLOWER COMPANY

"25 Years of Service in Air Engineering"

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NIAGARA

INDUSTRIAL COOLING • HEATING • DRYING
HUMIDIFYING • AIR ENGINEERING *EQUIPMENT*

vanes which conformed more accurately to correct contour than the original castings. The surface was smoother and denser and was free from sand holes and porosity, as compared to the original runner surface. The result was an increase in output of approximately 4% more horsepower than was obtained prior to welding. Also the cost of replacing runners is saved and their useful life prolonged where they would have been removed after approximately three years' operation.

Because of this maintenance experience specifications for a new unit at Boulder power plant require a stainless-steel welded surface at the entrance and discharge edges of the vanes, crown and band. Approximately 321.5 sq ft of welded surface are needed. The runner patterns allow for 1/8 in. stainless steel build-up in the heavier sections of the castings, but not on the vanes where the sections are thinner. This unit's operation over the next few years will give added information on the advantages of welding.

Readers' Problems

(*Continued from page* 113)

the correct location of the venting point. The trap can be installed by replacing an elbow with a tee in the main supply line where it drops down to feed the lower floors. A piece of pipe the same size as the main, approximately 18 in. long, on which to place the trap, should be added at the end of the tee. A ¾-in. trap will probably be large enough.

Brooklyn, N. Y. JOHN SALVIANI

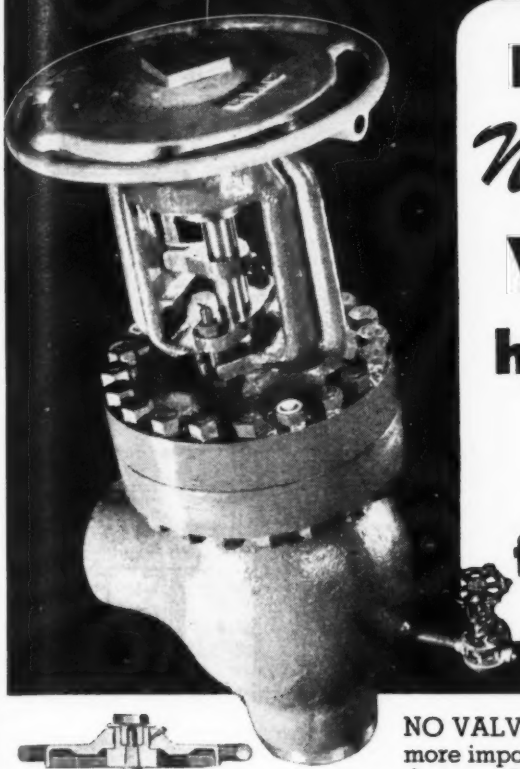
Low Pressure Liberates Air

HNF's HOT-WATER LINES contain air because water at normal atmospheric pressure dissolves about 2% air by volume. However, when the temperature is raised, solubility decreases about 0.5 to 0.75%. Excess air although soluble in hot water remains in the water provided the pressure is increased accordingly. However, since the building is about 13 stories high, there is an approximate difference of between 50 and 55 psi, which permits this excess air to form bubbles upon reaching the higher floors.

I suggest that he install a tank with a float valve in the riser on either the 12th or 13th floor to catch the air or vapor after the pressure has been re-

NUMBER THREE OF A SERIES ON VALVE SELECTION

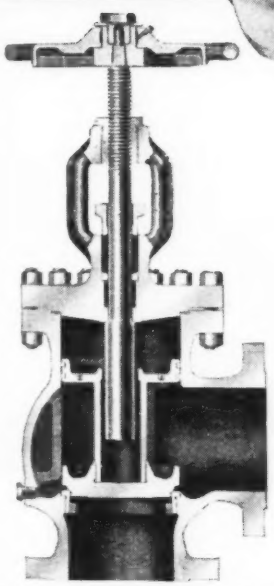
Here's how to buy a Non-Return VALVE



DO YOUR *Non-Return* VALVES have these 5 features?

1 IMPACTOR HANDWHEEL

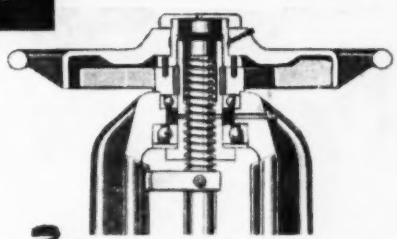
2 HOUR GLASS DISK-PISTON



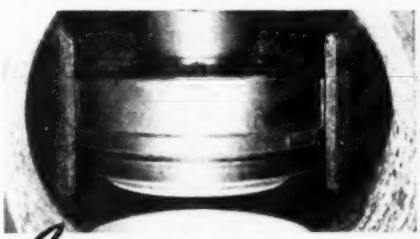
It pays to specify Edward non-returns for all steam pressure installations, from 150 lb upward. The valve above, rated at 300 lb, has all the desirable Edward design features that mean low cost operation at any pressure.

NO VALVES in the boiler plant are more important than non-return valves and none deserve more careful study before purchase. Here are five important features to look for in selecting non-return valves . . .

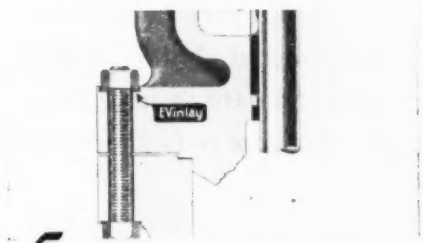
1. The most effective means for closing a valve against high boiler pressures is the Edward patented Impactor handwheel. A turn of the wheel exerts sledge hammer blows against the stem cross arm, giving maximum closing torque in minimum space.
2. Edward hour glass disk-piston gives maximum flow area without sacrifice of operating dependability. Piston rings are heat treated and hardened EValloy stainless steel.
3. Companion to the Impactor handwheel in larger valves, the Edward patented EValthrust yoke bushing sets new standards for easy operation. Double combination angular-radial ball bearings greatly facilitate tight valve closing.
4. Guiding is extremely important. Disks in Edward non-return valves are positively guided, without danger of hanging up, through three integrally cast and cored-out tear-drop design guide ribs and Edward seat guide lip.
5. Newest plus-value feature in Edward top temperature non-return valve construction is EVinlay facing for bonnet nut surfaces to end possibility of nuts seizing or galling on bonnet flange. Also applied to stem bearing surfaces.



3 EVALTHRUST YOKE



4 GUIDE RIBS



5 EVINLAY FACING

Edward non-return valves are built in all sizes with either flanged or welding ends for pressures from 150 to 2500 lb sp.

THE EDWARD VALVE & MFG. CO., INC. • EAST CHICAGO, INDIANA

EDWARD *Steel* VALVES

PATTERN IN SKILL

This fabrication is a pattern in piping. But it is also a pattern in skill. It is an unusual job of many welds. But it is also the product of unusual abilities.

Indeed, today as never before, unusual abilities in pipe fabrication are desired. Progress in science and industry has brought increasing dependence upon this field . . . And Associated has kept ahead, using certified welders highly efficient in the application of temperature control equipment, developing new welding procedures . . . putting a premium on skill. Associated offers progressive piping.

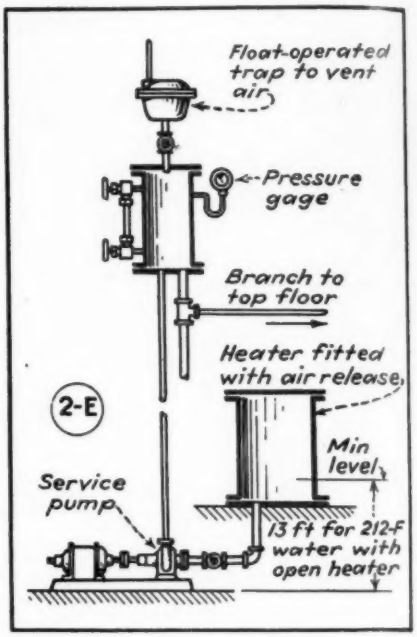
ASSOCIATED PIPING & ENGINEERING CO., Inc.
2332 East 38th Street • Los Angeles 11, California

duced relative to the tank's elevation.

When the float drops the valve opens and when the water restores to original level, the valve closes. Take care that the float is metal and does not collapse in hot water.

Also, prevent overheating the water as this would cause the added difficulty of steam forming. That is, water boils at 220 to 225 F on the top floor and in the basement at about 280F.

Redfield, S. D. L D KLOPFENSTEIN



Test Pump Packing Glands

FIRST DETERMINE whether trouble in the water distribution system is caused by air, steam or lack of water. Pressure and temperature readings in branch lines near the main should show the cause. Sketch 2-E shows one method of removing air from the system. The small head tank can be a pipe or any available fitting that stands the pressure. A gage glass and pressure gage provide a convenient check on operation.

If possible fit the heater with an automatically operated air vent. Air may be drawn into the system at the pump packing glands if the static head is too low. If raw city water is used large amounts of air will be released as heating takes place. Check existing branch-line piping to see that it is properly sloped without pockets.

Saint John, N. B. C G CLARK

Keep Water Temperature Down

AIR CARRIED into the heater by the cold water causes HNF's trouble. Heating separates the air and it rises to the

Plans specifying SUPER-SILVERTOPS PROVIDE FUTURE STEAM TRAP ECONOMY

Let's suppose your postwar plans call for steam-using equipment, requiring 25 to 100 steam traps. What trap will you specify? You can specify a steam trap requiring the purchase of seven fittings and several hours installation time . . . that will have to be taken off the line for inspection or change of parts. Or, you can specify a Super-Silvertop Steam Trap that requires only one fitting . . . that saves an hour's installation time and can be inspected without removal.

Multiply these savings, both now and over the years, by the number of traps you will need and you'll find that for steam trap economy it's much more economical to install Super-Silvertops in the beginning and be assured of years of dependable, economical steam trap service.

Send for a copy of the book, "How to Choose a Steam Trap", give it some study before you specify any steam trap for new installations.

THE V. D. ANDERSON CO.
1934 WEST 96*th* STREET • CLEVELAND 2, OHIO

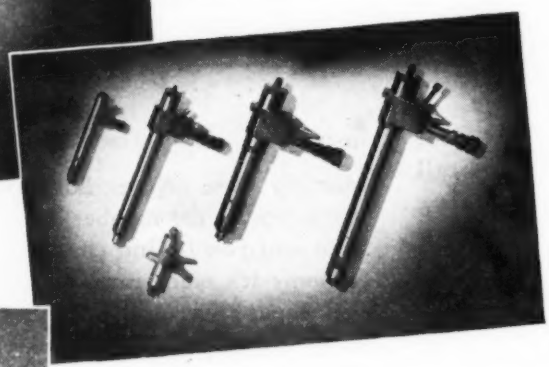
Super-Silvertop
STEAM TRAPS

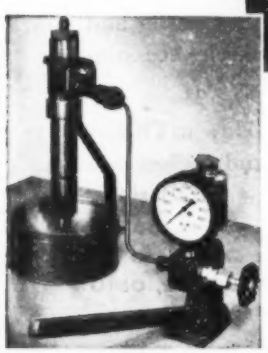
SAFEGUARD DIESEL ENGINE PERFORMANCE

with Dependable ADECO

FUEL INJECTION EQUIPMENT

Adeco equipment is engineered to secure the optimum performance of the engine you are building or plan to build. Today's line of fuel injection pumps, nozzles and nozzle holders is the most dependable in Adeco history—the result of years of pioneering and research for the diesel industry. Their performance speaks louder than words in pointing the way to the finest in diesel fuel injection equipment.





ADECO NOZZLE TESTER for LOW-COST MAINTENANCE

America's most widely used Nozzle Tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors. Avoids costly delays and possible damage to engine. Also obtainable with Navy-approved gauge. Write for bulletin.

Ideal for Testing Hydraulic Equipment

ADECO

AIRCRAFT & DIESEL EQUIPMENT CORPORATION

4401 RAVENSWOOD AVENUE, CHICAGO 40, ILLINOIS

system's highest point. The trouble can be eliminated by installing a vent at the top of the riser.

If the hot water is supplied from a tank in the attic, vent pipe needs to be only high enough above tank to take care of the difference in height between the hot- and cold-water columns. It may be easier and cheaper to install a float-controlled vent made especially for venting air from water lines.

Water in the heater should be kept below 180 F if possible to prevent steaming and forming scale in the heater.

Lombard, Ill. H D BROWN

Suggests Surge Tank And Atmospheric Relief

I SUGGEST a surge tank above the 13th floor to provide space at the top of the system for the expelled air and keep it out of the supply lines. An atmospheric relief, or back-pressure valve, connected to the top of the surge tank releases the compressed air when the pressure reaches a predetermined point. This valve can be set according to the required pressure head in the system, and would act similarly to an atmospheric relief valve on a deaerating feedwater heater.

Arvida, Quebec L A PETRIE

C A Wilkes, Oaklyn, N. J., says to eliminate air pockets in branch lines and check circulating line for obstructions. John Campbell, Jr, New York. N. Y. suggests installing a float-operated air vent.

Economical Power

(*Continued from page 70*)

Assume this refrigeration energy is purchased on a demand rate where the demand is established on a yearly basis. Once a high demand is established no saving accrues by holding future demands down during subsequent months, since the billing for the remainder of the year is at the established figure unless exceeded, except, of course, for kwhr reduction from a lower demand.

On the other hand, if a new demand is established each month, the engineer can operate to reduce demands in succeeding months, even though the last higher demand was necessary. Never use average costs per kwhr, upon either a monthly or yearly basis when making estimates of increase or reduction in

When there's "no other way"... look to

AMERICAN SEAMLESS FLEXIBLE TUBING!

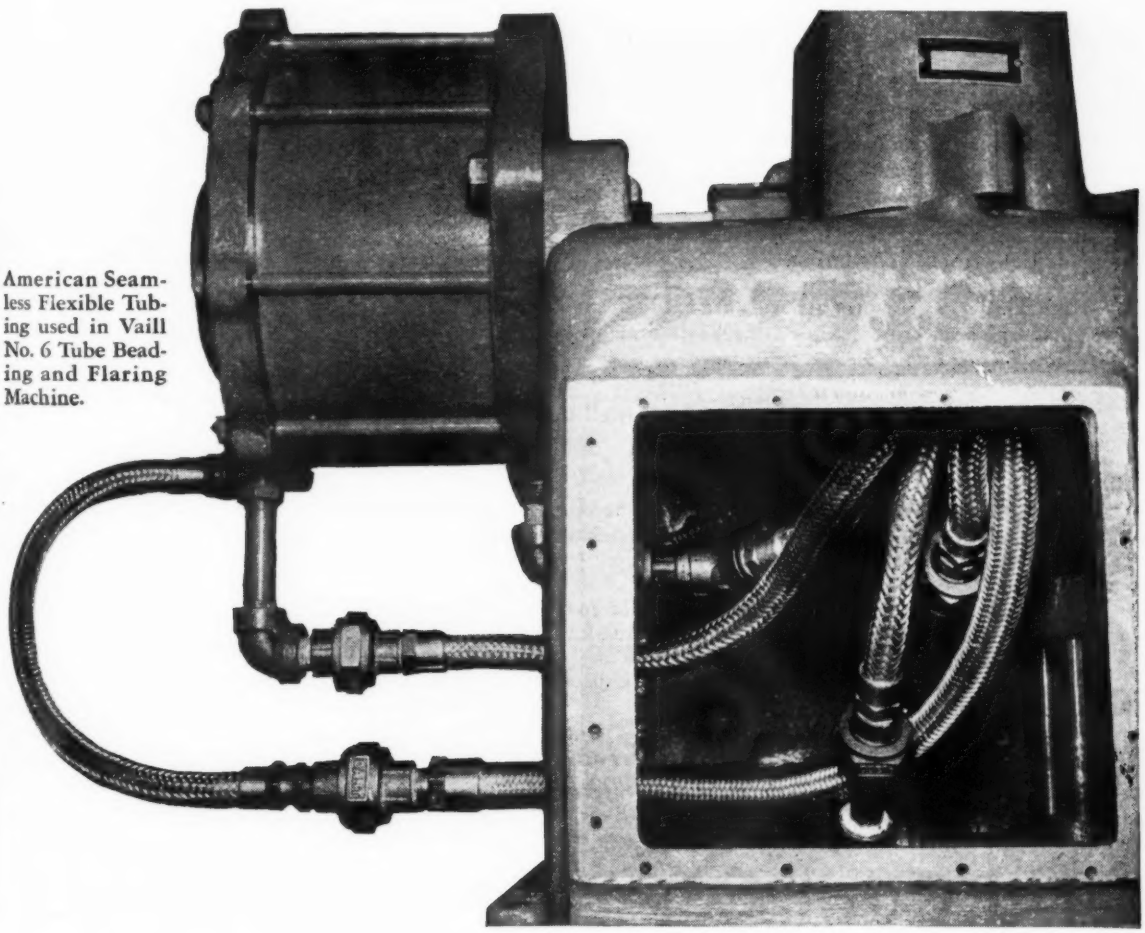
THE AIR LINES of this Vaill No. 6 Tube Beading and Flaring Machine are made of American Seamless Flexible Tubing. Four lengths of ⅜" tubing connect two ports on each of two cylinders with the air control valve. A fifth length of ½" tubing carries the main air supply to the valve.

Mr. John L. Vaill, president of the Vaill Engineering Company, points out that, while there is no movement in the flexible tubing once it is installed, lack of space made it impossible to make the connections with rigid pipe. The use of preformed copper tube was also considered but discarded as impractical. American Seamless Flexible Tubing, as illustrated, is installed regularly in these units in less than an hour's time.

Whenever you have a problem in conveying liquids or gases, in connecting moving or misaligned parts, isolating vibration or in shielding electric wiring, remember that there is an American Metal Hose product that will solve your problem. Assistance of our Technical Department is available on request. Write for our new 40-page Catalogue, SS-50, describing Seamless Flexible Tubing.

44190

AMERICAN METAL HOSE BRANCH
OF THE AMERICAN BRASS COMPANY
Subsidiary of Anaconda Copper Mining Co.
General Offices: Waterbury 88, Conn.
In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*



American Seamless Flexible Tubing used in Vaill No. 6 Tube Beading and Flaring Machine.

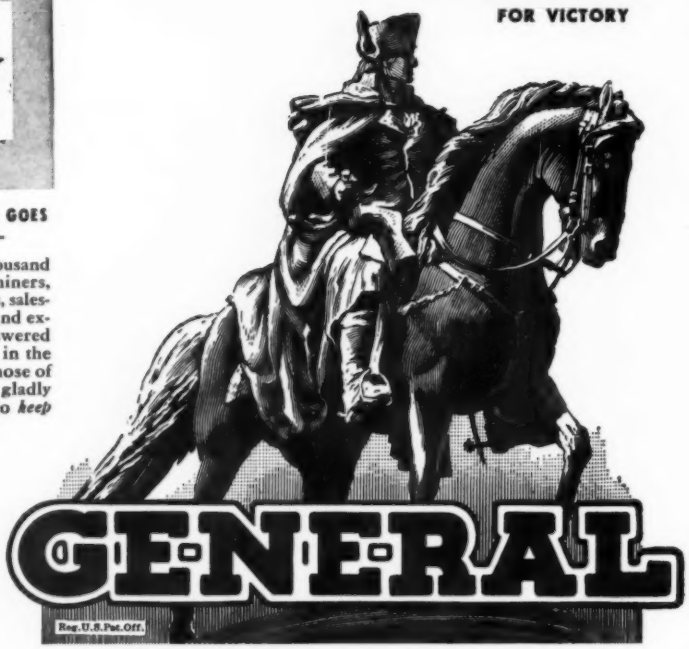
ANACONDA
from mine to consumer

American Metal Hose

GENERAL COAL GOES TO WAR—

More than a thousand of our men—miners, machinists, clerks, salesmen, engineers and executives have answered the call to serve in the armed forces. Those of us left behind gladly "Close Ranks" to *keep the coal rolling.*

BUY WAR BONDS FOR VICTORY



GENERAL

Reg. U.S. Pat. Off.

RODA — High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

IDENDRON — High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA — High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX STOKER — A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

COKE — Roda and Stonega from Wise County, Va., and Connellsville Coke from Pennsylvania.

CRITERION COAL — High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER — Genuine Third Vein Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

Admiralty Coal — Genuine New River Smokeless, Beckley or Sewell seam from Raleigh County, W. Va., C. & O. and Virginian Railroads.

Old Kentucky — Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

GENCO — Steam and domestic coals from a number of producing districts.

ANTHRACITE—Hazle Brook Premium . . . Raven Run

Our personnel with the experience gained through long and varied marketing activity assures proper application of one of the above brands and effective servicing of any fuel requirement.

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the power cost from operation changes.

For example, assume you are considering adding electric-heating equipment and that energy is purchased on the Wright maximum-demand rate in which the demand is established on a yearly basis. Suppose the average power cost is 4.5¢ per kwhr, and the electric-heating equipment is not used during peak demands. Applying the average rate shows a cost of 4.5¢ per kwhr, whereas the actual cost is only 3¢.

To sum up, if the engineer knows (1) the rate under which power is purchased and (2) how the operation of his equipment affects the demand for and consumption of power, he can operate the equipment to lower the over-all power cost. Of course, he must always balance the saving made against the cost and inconvenience of making it. (See "Too Low A Head Pressure Can Cost You Money," by A B Duryee, page 103, Nov, 1943, POWER.)

The Diesel Field

(*Continued from page* 101)

Maintenance of a Crude-Oil Pipe Line Without Spare Units," by John G Norton, chief mechanical engr, Magnolia Pipe Line Co. After describing the line, which runs from Patoka, Ill. to Lima, O., and its diesel pumping equipment, Mr Norton outlined the scraper program and the duties of operating and maintenance personnel. Operation without spare units imposes heavy demands and the maintenance policy is geared to this condition. All stations are equipped with the best possible selection of tools, special apparatus for routine maintenance and essential materials, as well as an adequate supply of repaired and spare parts. Parts are changed or repairs made when signs of trouble first develop.

Mr Norton discussed in some detail the maintenance schedule and procedures on exhaust and inlet valves, crankshafts and main bearings, pistons, rings and liners, fuel system and spray valves. Careful attention is given to a regular program of indication and to lubrication and purification of lube oil. With high-grade personnel, fully planned maintenance, and accurate reports and records, operation of this pipeline has been highly successful.

A session on engine control for aircraft, marine and railroad applications included "Hydraulic Controls for Aviation, Marine and Railroad Equipment," by W C Trautman, chief engr, hydraulic

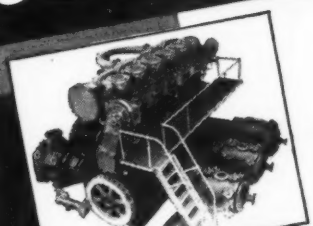
2-CYCLE FOR *Continuous* POWER

SIMPLE PORTS
instead of moving valves mean
SUSTAINED Fuel Economy!

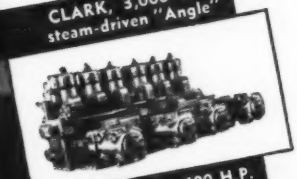
Moving valves, for intake and exhaust, deteriorate and allow fuel leakage. Thus, in 4-cycle engines, initial fuel economy is not maintained.

In 2-cycle engines, however, simple ports handle intake and exhaust and cannot deteriorate! Thus, in the 2-cycle, initial fuel economy endures for the life of the engine!

The CLARK Super-2-cycle "Angle" offers you sustained fuel economy..and a new low in fuel consumption.



CLARK, 3,000 H.P. steam-driven "Angle"



CLARK, 2-cycle 600 H.P. gas-driven "Angle"

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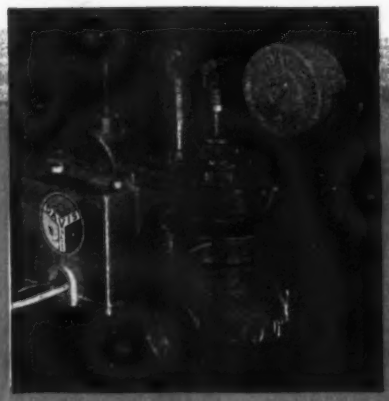
Export Offices: 30 Rockefeller Plaza, New York. Domestic Sales Offices and Warehouses: Tulsa, Okla.; Houston, Tex.; Chicago, Ill. (122 S. Michigan Av.); Boston, Mass. (Park Square Bldg.); Huntington Park, Calif. (5715 Bicket St.). Foreign Offices: London, England; Avda Roque Saenz Pena, 832 Buenos Aires.

CLARK SETS THE PACE IN COMPRESSOR PROGRESS



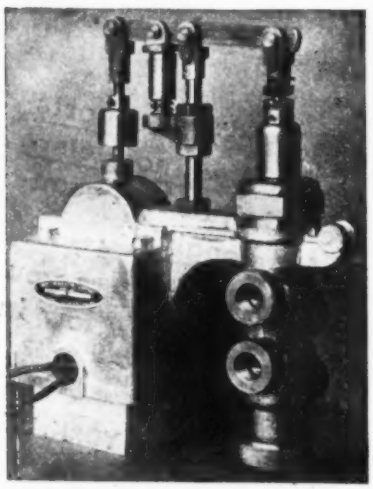
make it Automatic

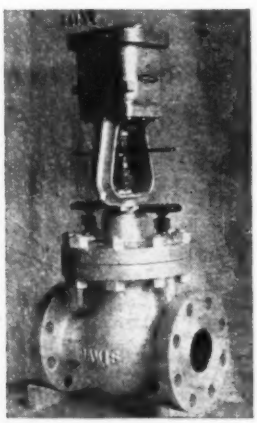
with Davis Industrial Type Solenoid Valves

Freedom from manual control and from fear of disastrous failures is yours when you specify Davis Solenoid Valves. These valves are available for steam, gases and liquids in sizes from 1½" to 12" and pressure to 1500 lbs. Any device capable of making or breaking an electrical circuit will operate Davis valves. Available with either normally closed or open valves, explosion proof solenoid boxes and two step action when extreme accuracy is required.

Wherever an automatic valve will improve your piping system, be sure to write Davis engineers for recommendations. You'll be certain that Davis will furnish the right valve for the job. Informative literature available.

Below—No. 380—a 3 or 4-way pilot valve widely used on air or liquid actuated power cylinders.





Above—No. 93-H with solenoid operated pilot valve and hydraulically actuated main valve built for use on a 400 lb. pressure water main.

DAVIS REGULATOR COMPANY

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DAVIS REGULATOR COMPANY

development engrg div, Bendix Aviation Corp, and "Pneumatic Control Systems," by R R Stevens, Westinghouse Air Brake Co. The concluding session, on governing, included "Hydraulic Speed Control of Diesel Engines in Pipeline Pumping Service," by J R Polston, engr, Stanolind Pipe Line Co, and "Timing of Governor Response on Diesel Engines Driving Ac Generators in Parallel," by P L Giering, Stevenson, Jordan and Harrison, Inc, and W E Skinner, U. S. Army Engineer.

Engineer's Books

(*Continued from page* 122)

tions, problems and simple engineering applications are given. Engineers will find helpful presentations of the principles of accuracy in computation, use of slide rule and graphical methods.

Chapter headings include: Numerical Computations, Simple Algebraic Operations, Functions and Their Graphs, Trigonometric Functions, Graphs of the Trigonometric Functions, Simple Properties of Vectors, Algebraic Operations, Exponents and Radicals, Logarithms, Fundamental Relations of Trigonometry, Oblique Triangle, The J Operator, Linear Equations and Determinants, Quadratic Equations and Equations of Higher Degree, The Straight Line, Circle Equations and Loci, Equations of the Second Degree: The Conics, Elements of Solid Analytic Geometry, Elements of Differential Calculus, Elements of Integral Calculus.

APPLIED SAFETY ENGINEERING (*first edition*, 1943) *By H H Berman, safety engineer, Consolidated Gas Electric Light & Power Co, instructor in safety engineering, University of Maryland, and H W McCrone, field engineer, Baltimore Safety Council, instructor in safety engineering, University of Maryland. Published by McGraw-Hill Book Co*, 330 *W 42nd St, New York*, 189 *pages*, 5x8 *in., cloth*, $2.

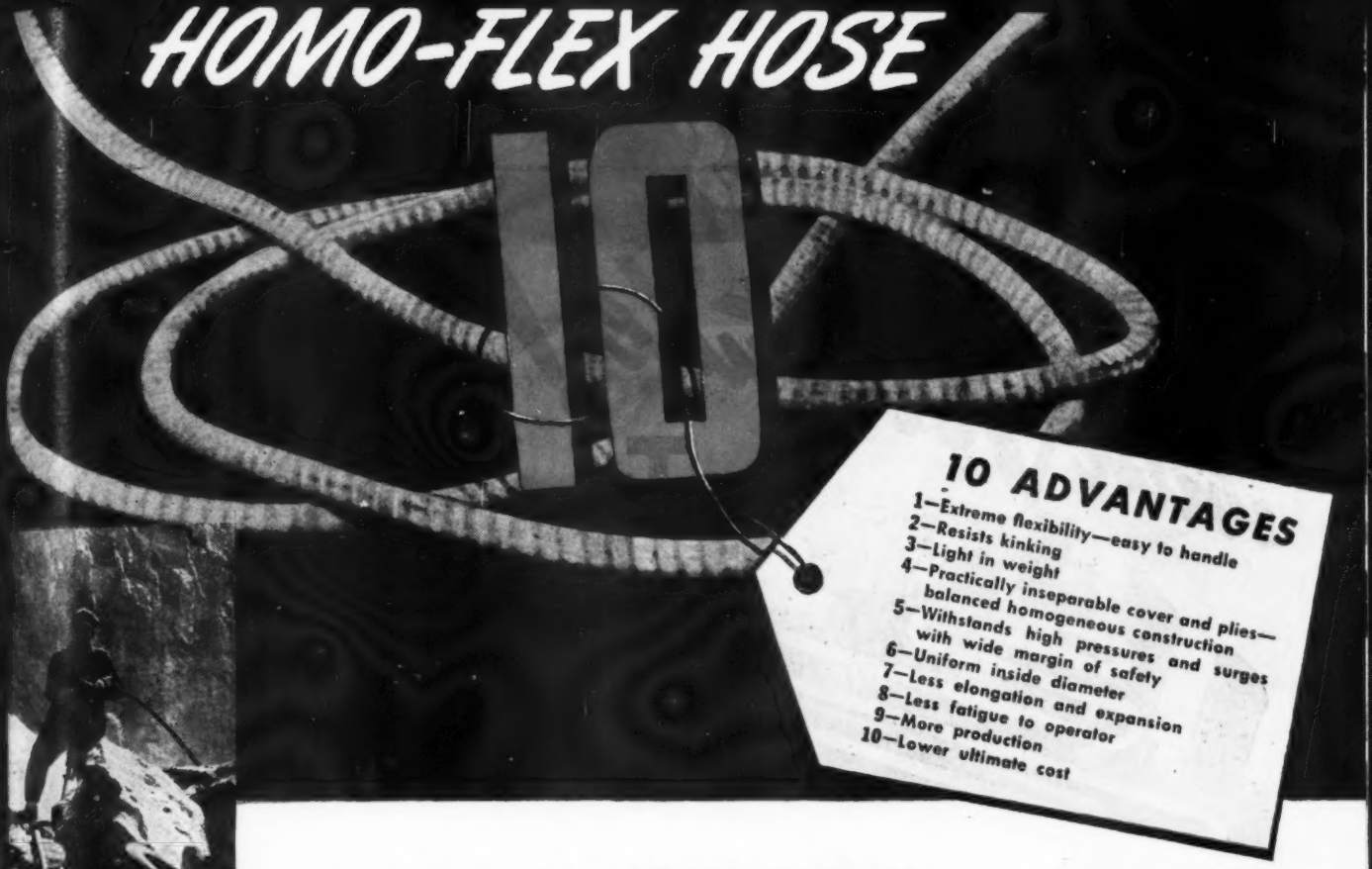
Here is the "how" of safety engineering, giving methods of approach that have been tested and proved successful. It is not an exhaustive treatise but has been purposely limited to a few of the most important phases of activity that seem most difficult to put into practical operation.

The opening chapter is devoted to "Basic Considerations," then the fundamental requirements for a successful program are given under "Getting Down to Cases."

"How to Make Investigations," is based on well-established practices of successful investigators with specimen investigation reports. Covered also is how to write safety rules and regulations, as well as safety messages.

Other chapters are "How to Hold Safety Conferences," "How to Make A Safety Talk" and "How to Make a Safety Inspection." This straightforward, understandable text is a pioneering adaption of

HOMO-FLEX HOSE



—a MANHATTAN Development

brings you 10 advantages important in war or peace

IN WAR—The homogeneous and extremely flexible construction achieved by MANHATTAN Strength Members of super-strength cords and the balanced, engineered method by which they are applied and inseparably combined with the FLEXLASTICS* tube and cover, together give a service impossible a few short years ago.

Every one of these advantages contributes to greater production through less fatigue to operator and to much longer hose life—therefore fewer interruptions.

Still another MANHATTAN advantage—Turnate Vulcanization—imparts added strength to Homo-Flex Hose. This process applies pressure progressively before and during vulcanization to give not only uniform inside and outside diameters, but also uniform texture and resilient strength. The distinctive spiral marking identifies Turnate Vulcanization.

IN PEACE—All these advantages will have cumulative value for you in the forthcoming competitive period. Then the multiple economies of long service life; resistance to high working pressures and surges; easy handling with less operator fatigue because of its light weight; toughness to withstand wear, abrasion and kinking; will help keep costs down and profits up.

Manhattan's Condor Brand Homo-Flex Hose is or will be available in types for the following services: Air, Water, Steam Pressing Iron, Orchard Spray, High Pressure Mine Spray, High Pressure Oil Spray.

Buy more BONDS to bring the boys down the home stretch

*The term FLEXLASTICS is an exclusive MANHATTAN trade mark. Only MANHATTAN can make FLEXLASTICS.

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THE MANHATTAN RUBBER MFG. DIVISIO
of Raybestos-Manhattan, Inc.
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INTESTINES with Fortitude!

PTP

Seamless steel tubes are the intestines of the ship, the power plant, the oil refinery, the locomotive, and the chemical plant...delivering an ever-flowing flood of power to America's mighty production efforts.

Seamless steel tube "know-how" is vitally necessary to keep those lines going steadily. Cold drawn seamless steel PTP tubing achieves accuracy to size and uniformity of gauge through exacting control and thorough inspection at every step in manufacture. Where cost is a factor, and seamless steel tubing required, PTP tubing offers an economical and satisfactory solution to the problem.

★ Official United States Navy photograph. 440 series destroyer; a component part of the great American Fleet, largest in the history of the world.

PIPE & TUBE PRODUCTS
INCORPORATED
Manufacturers of Cold Drawn Seamless Steel Tubing
JERSEY CITY, N. J. • WORKS: READING, PA.

the case method of study for industrial accident prevention. No stone is left unturned in developing the answers to each case as it is handled through the various stages of study.

HEATING, VENTILATING AND AIR CONDITIONING GUIDE FOR 1944 (*22nd edition*) *Published by The American Society of Heating and Ventilating Engineers, 51 Madison Ave, New York.* 1168 *pages,* 6x9, *cloth,* $5.

The industry's latest developments and improvements have been added to much valuable information carried over from previous editions.

Tables of heat transmission coefficients have been completely revised to include materials and constructions not previously listed and eliminate obsolete constructions.

Revised data on air stratification in high-ceiling rooms, moisture permeability for various materials, predicting residence heat loss and latest degree-day information compiled by the Weather Bureau, are only a few of the new items.

The catalogue section presents a greater variety of products by an increased number of manufacturers.

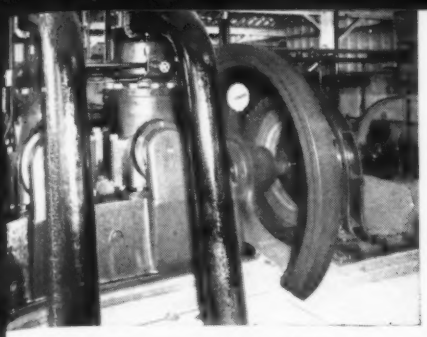
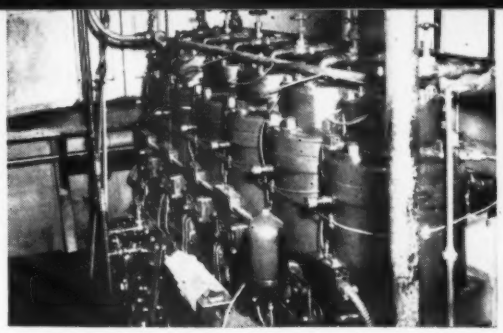
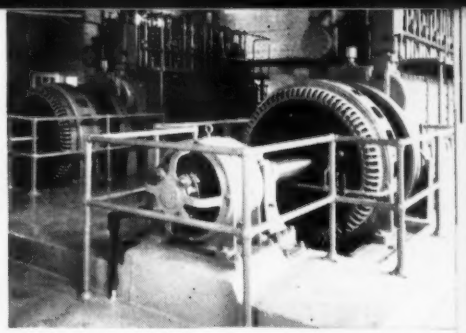
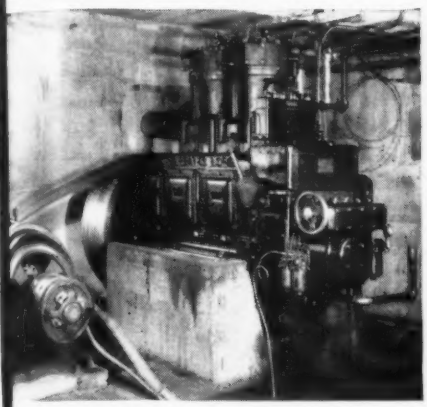
PRACTICAL DESIGN OF WELDED STEEL STRUCTURES (1943). *By H M Priest, engineer, railroad research bureau, U. S. Steel Corp Subsidiaries, formerly designing engineer, American Bridge Co. Published by American Welding Society, 33 W 39th St, New York 18, N. Y.* 150 *pages,* 5¼x8 *in., numerous charts, cloth.* $1.

This little book deserves high praise. It is practical, concise and authoritative—a working manual for designers and constructors who want to do their job right in all respects, without unnecessary reading of voluminous treatises. Main headings are: Welding Processes, Welding Rods and Electrodes, Forms of Joints, Gas Cutting, Qualification and Inspection, Codes and Reports, Stress Distributions and Stress Paths, Temperature Effects, Design Considerations, Continuous Structures, Rigid Frames, Fatigue, Bibliography.

CONTROL OF ELECTRIC MOTORS (*second edition,* 1944) *By Paisley B Harwood, manager of engineering, Cutler-Hammer, Inc. Published by John Wiley & Sons, 440-4th Ave, New York 16, N. Y.* 479 *pages;* 244 *illustrations;* 59 *tables; cloth.* $5.

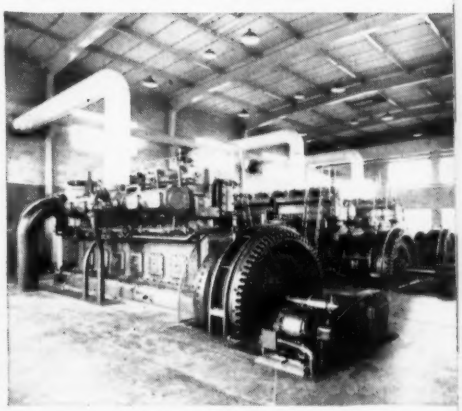
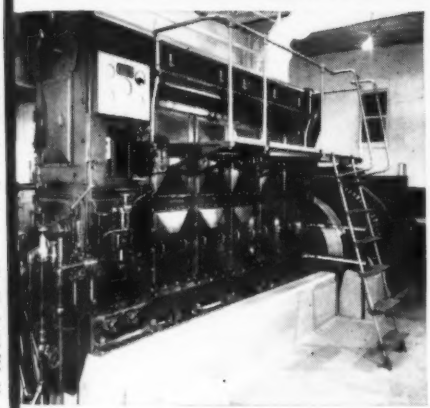
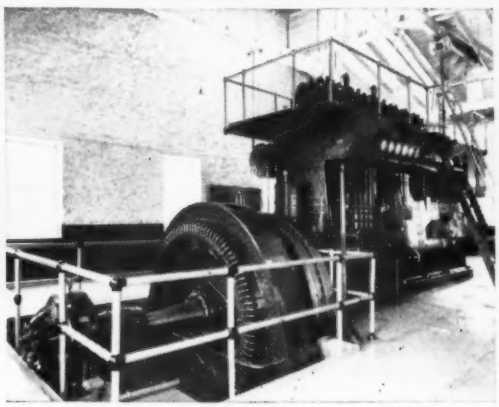
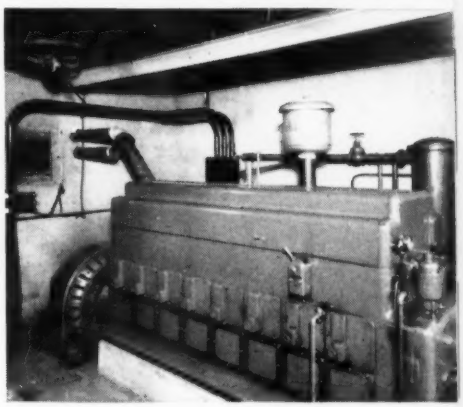
All electric power applications involve a motor, a controller and equipment to connect the motor to its load. Successful motor applications depend on correct coordination of all three with the characteristics of the driven machine. The opening chapter showing how this is done is followed by three chapters on dc and ac relays, pilot devices and accessories. Then come descriptions of accelerating methods, wiring diagrams, control apparatus and magnetically operated brakes. Six chapters are devoted to dc motors and their controllers and four to ac motors and controllers. One chapter covers starting- and speed-control-resistor design and another, electronic control for motors.

This edition has been completely revised to conform to latest practice, and contains

Which do your Diesels need...

Detergent or non-detergent oil?

Get an unbiased answer from a Standard Lubrication Engineer...he has both types

● IS YOUR DIESEL equipment hard to keep clean? Do exhaust ports fill up fast? Are rings stuck on some engines every time you inspect them? Is cleaning needed more often now than formerly?

Maybe you need a heavy-duty, detergent-type oil—Nonpareil H.D. Diesel Oil. Or you may only need a better, cleaner-running, straight mineral oil than you are now using—such as Nonpareil Diesel Oil. Wouldn't you like to get an unprejudiced opinion from an Engineer who has experience with both types of oil? Who has reason to *sell* you one type or the other?

If you can get clean, trouble-free operation on straight Nonpareil, it is the most economical to use. It is lubricating hundreds of engines in Municipal and Industrial plants throughout the Middle West—has for years.

Nonpareil H.D. is a heavy-duty detergent oil developed particularly for industrial Diesels. It has taken over some of the harder jobs of Diesel lubrication where wartime loads and fuels have affected operating conditions, and smaller crews are available for cleaning and maintaining engines.

A Standard Lubrication Engineer can not only make an unbiased recommendation of the oil which will give you the best service, but he'll give you the names of plants—perhaps near your own—where Nonpareil is lubricating the same kind of engines you have, under operating conditions similar to yours. Call the nearest Standard Oil Company (Indiana) office, or write 910 S. Michigan Ave., Chicago 80, Ill., for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

Gasoline Powers the Attack . . .

Don't Waste a Drop!

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Lubrication *News* letter

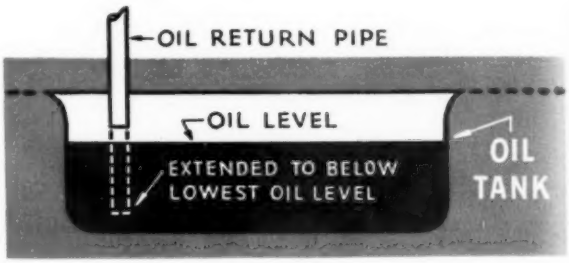
Practical suggestions from the field on how Lubrication Engineering and lubricants are being used by midwest operators to lick tough wartime jobs.

JULY, 1944

10 years without a grease line stoppage in a one-shot lubricating system is good news to any plant. It's a particularly good record at a Minnesota bottling plant where a Farval system of 75 outlets lubricates a bottle washer. Credit is given Superla Grease No. 39 for operating all of these years without separating or caking in the line even under wide temperature variations and wet conditions.

Burlap bags were used to catch grease thrown from turbo-blower bearings in a shell loading plant. High speed (3,600 rpm) and heat (220°F) combined to make bearing lubrication a problem on this blower. It operated constantly, too. Before Superla Grease was used, it was not only necessary to catch grease leakage with burlap bags, but shutdowns were frequent. With Superla, the blower ran 2,880 hours before stopping it to clean and repack bearings. A real saving was made in down time and lubricants . . . and burlap bags.

Grease that would last a full shift on the ring gear of a bottle washing machine was one thing a brewery engineer prayed for. Water washed most lubricants off almost as soon as the machine started. A grease that would last through an 8-hour shift seemed the ultimate in good lubrication for the engineer. Then a Standard Oil Engineer suggested trying a sample of Calumet Viscous Lubricant 10X. It lasted one shift easily. There was plenty of lubricant left at the end of the second shift—even some at the end of the third. It was found that an application once in three shifts kept the ring gears well lubricated. Ask anything within reason of a Standard Lubrication Engineer. He'll usually have a more than reasonable answer.



Oil foaming in a turbine system troubled a building power plant engineer. It was bad enough at times to cause an overflow in the tank—a loss of good oil. At a Standard Engineer's suggestion, a change was made in the oil return line so that it discharged well below the level of the oil in the tanks. It had been located at the top of the tank where the flow agitated the oil. This change was all that was needed—foaming stopped.

Simple suggestions like the above may answer many of your questions about lubrication. Give a Standard Lubrication Engineer a chance to answer them. Write Standard Oil Company (Indiana), 910 S. Michigan Avenue, Chicago 80, Illinois, for the Engineer nearest you. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

Gasoline Powers the Attack . . . Don't Waste a Drop!

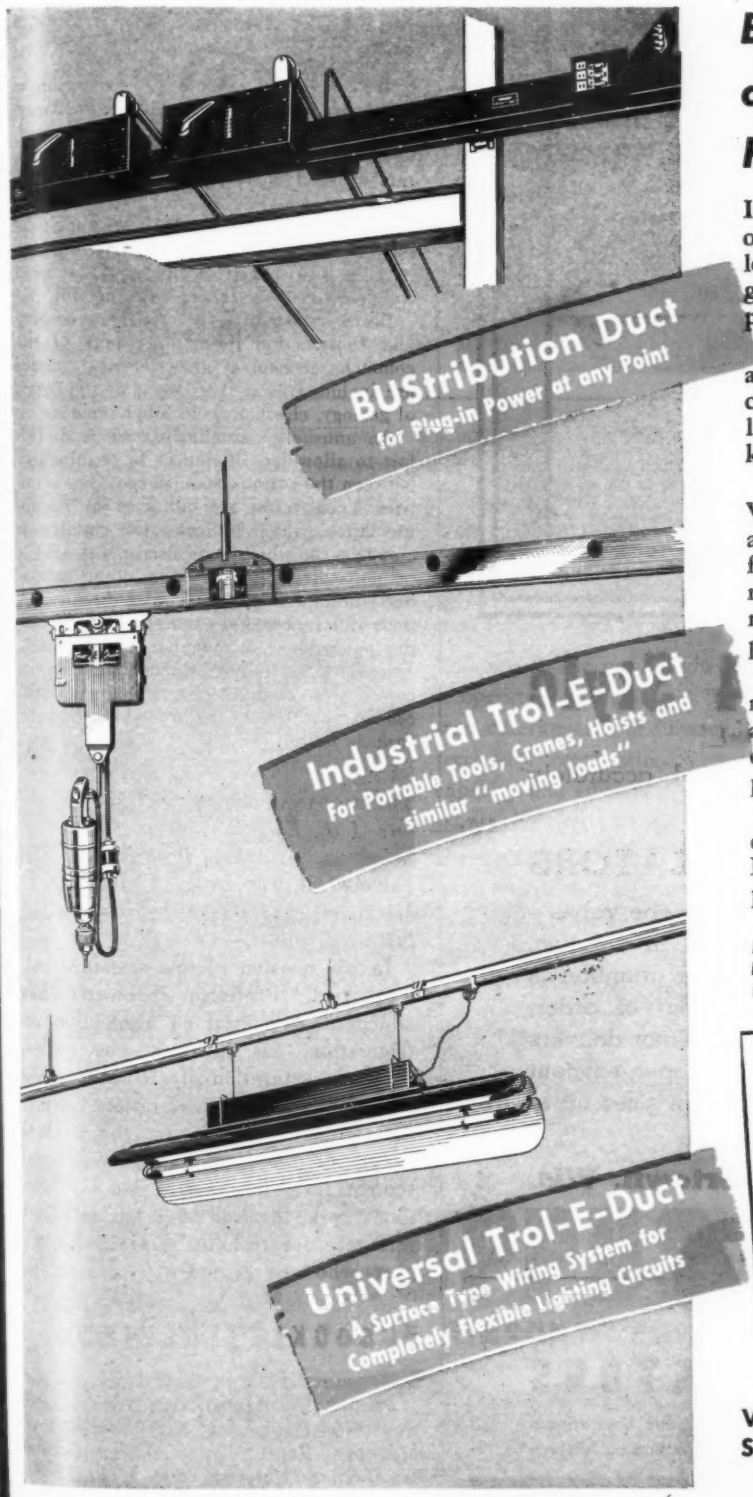
STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING

3505 BULLDOG INSTALLATIONS

In America's Largest Manufacturing Plants

WILL SPEED RECONVERSION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A Surface Type Wiring System for Completely Flexible Lighting Circuits

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In thousands of *major* U. S. war plants, new and old, BullDog Electrical Systems have saved countless hours on installation and maintenance — greatly reduced changeover time — helped keep production at top speed and efficiency.

How? By making plug-in power immediately available for any shop set-up. By bringing power close to portable tools on any type of production line. By putting light close to the work on any kind of operation.

An Asset in the Postwar Race

When these BullDog-equipped plants get the go-ahead for reconversion they will again be out in front in the production race — and for the same reasons. Their flexible electric systems will be ready for even the most sweeping changes of product, plant layout or tool set-up.

To manufacturers—large or small—who have not yet installed this modern method of power and light distribution, BullDog offers the services of expert field engineers, to help in planning postwar operations.

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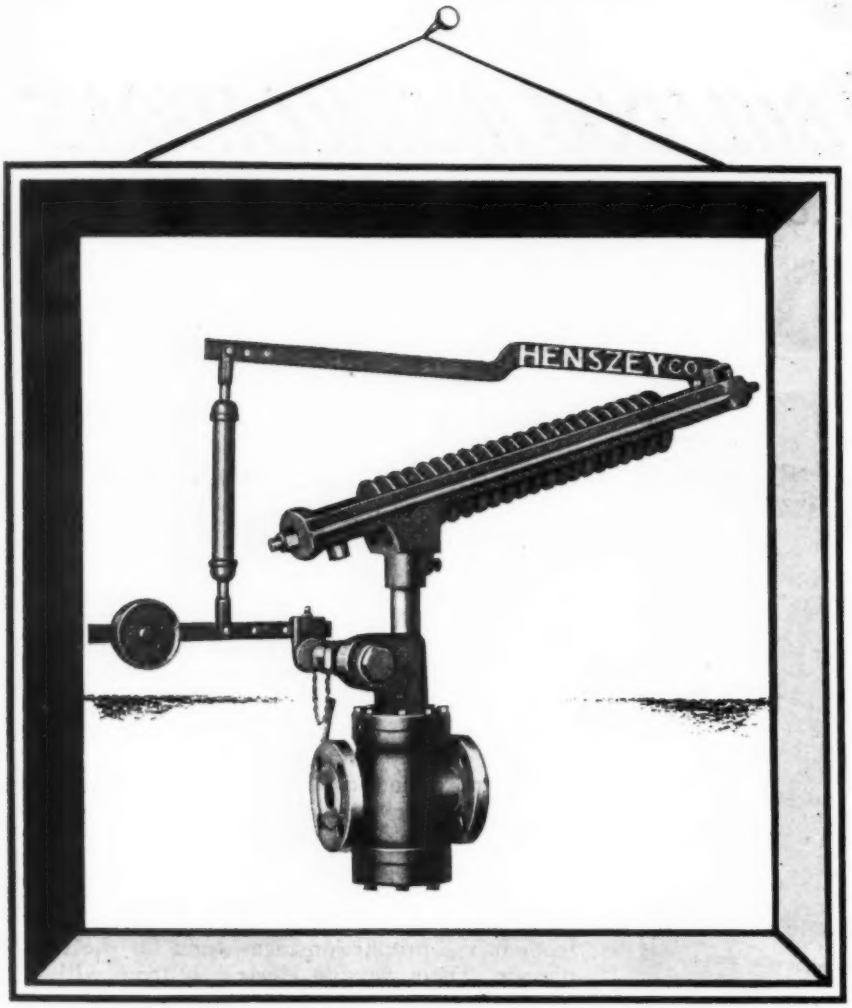

MANPOWER 1944 Style

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Control boiler water levels continuously and accurately under ALL LOAD CONDITIONS with

HENSZEY *Boiler Feed* REGULATORS

These units are as easy to install as a gate or globe valve—no additional supports needed—they go right in the line. Once installed and set for operation no further attention is necessary—nothing to rust—nothing to get out of order. When the boiler needs water the Henszey Regulator delivers it—just enough to bring the water back to the proper, efficient level. Made for pressures up to 600 lbs. and in sizes up to 4 inches. Send for bulletin giving details.

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almost 100 more pages. One chapter has been added on variable-voltage control and another on synchronous motor control. Many new tables give ratings of motors and controllers. Arrangement has been radically changed: controllers are now described in the chapters covering type of motor to which they apply. Treatment is practical throughout. Where mathematical formulas are used they can be omitted without interfering with an orderly study of the text.

ENGINEER'S DICTIONARY—SPANISH-ENGLISH AND ENGLISH-SPANISH (1944) *By Louis A. Robb. Published by John Wiley & Sons Inc, 440 4th Ave, New York, N. Y. 423 pages, 5½x7¾ in., limp binding.* $6.

With the expected postwar expansion of export trade, particularly with Latin America, emphasizing the need for closer engineering relations with foreign countries, this book should be extremely valuable to technical men. It grew out of the author's need in his own professional work for Spanish equivalent of familiar American engineering and construction terms, a need which existing dictionaries did not fill.

Basic emphasis is on civil engineering and construction terms but many of the common mechanical and electrical usages are included as well as some of the terms of geology, chemistry and other sciences.

An unusually valuable feature is the effort to allow for differences in terminology between the various Spanish-speaking countries. Local terms are indicated by an abbreviation, which indicates the country or countries in which it is used. This should be particularly helpful in avoiding misunderstandings that might arise because of these differences. For example, *usina*, meaning *powerhouse*, is peculiar to Argentina, Uruguay and Bolivia, where it is the accepted term in place of *estacion de fuerza, central electrica, central generadora*, or *casa de fuerza.*

THERMODYNAMICS, *(fifth edition) by the late J E Emswiler, revised by F L Schwartz, Associate Professor of Mechanical Engineering, University of Michigan.* 335 *pages, 5½x8½ in., illustrated.* $3.

In his revision of this standard college text, Professor Schwartz has added new material on absorption refrigeration, gas turbines, gas cycles, adiabatic saturation of air-water vapor mixtures and supersaturation. While the revised volume follows the original presentation of material in most convenient form for student use in classroom work, the text offers an excellent reference for technically trained engineers who wish to review fundamentals.

BOOKLET REVIEWS

SYMPOSIUM ON THE IDENTIFICATION OF WATER-FORMED DEPOSITS, SCALES, AND CORROSION PRODUCTS BY PHYSICO-CHEMICAL METHODS Reprint *by American Society for Testing Materials, 260 S Broad St,*

This is what increases THRU-PUT from any Gas-Fired Equipment!

THIS PINWHEEL ACTION is what a Coppus-Dennis FANMIX Gas Burner creates to give greater heat release per cubic foot of furnace volume.

The driving force is gas under pressure. Escaping from radially-spaced orifices in the arms, it causes the fan to rotate. In turn, the fan's rotation causes intake of air at right angles to the path of the gas. Gas and air thus mechanically mixed . . . the proportions are automatically correct, **BECAUSE**

1. the number of orifices, as well as the gas pressure, determines the gas flow
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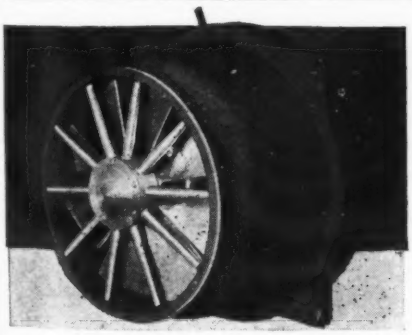
FANMIX "pinwheel action" is the closest to theoretically perfect proportioning of any gas-burning device. It gives thorough, accurate mixing . . . for complete combustion, without impingement.



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Today, you can get a higher, even furnace temperature, no drifting "Hot spots" . . . stop deterioration of furnace lining due to secondary combustion . . . increase boiler capacity and efficiency.

FANMIX will save combustion space by relieving the furnace of having to serve as a mixing chamber . . . save stack height by preventing draft loss across the burners . . . reduce pipe sizes . . . eliminate forced draft equipment, etc.

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Flue Gas Analysis: over 11% CO_2, fraction of 1% of O_2, and no CO.

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"COAL IS TIGHT! This winter it will be tighter— an estimated 20-million-ton shortage"
—GEORGE EDWARDS
Advisory Editor
POWER, MAY 1944

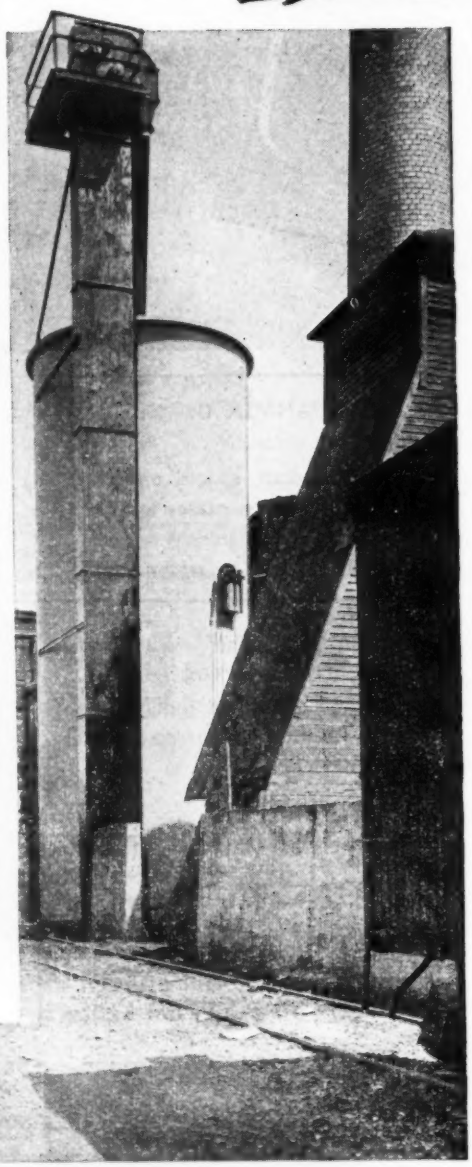
HANDLE "CRITICAL" COAL THE G-W WAY

Authorities continue to warn of an impending shortage of coal . . . of manpower . . . of transportation, imposing a crisis in the coal industry—which means *all* industries.

Power plants have sensed the situation — wise managements are checking possibilities for greater fuel conservation. They are turning a questioning eye on their present coal storage and handling methods.

In hundreds of installations G-W systems have proved themselves under wartime and normal conditions. As designers and builders of coal storage and handling systems G-W is ready to apply its unsurpassed 130 years' experience to your problems.

By an ingenious combination of standard and special designs G-W can meet your individual requirements promptly, efficiently and economically, in co-operation with your own engineers. Why not ask for a plan and proposal? Catalog P-200 will give you help, too. Write for a copy.



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Philadelphia 2, *Pa.* 44 *pages*, 6x9, *heavy paper cover*, 65¢. Booklet includes three technical papers, general discussion and introduction describing physico-chemical methods in identifying water-formed deposits, scales and corrosion products. Technical papers cover: "X-ray Diffraction Methods in the Study of Power Plant Deposits," C E Imhoff and L A Burkhardt; "Diagnosis of Water Problems at Limbo Station," Everett P Partridge, R K Scott and P H Morrison; "The Interpretation of Analyses and Problems Encountered in Water Deposits," J A Holmes and A O Walker.

INTERPRETATION OF ANALYSES AND PROBLEMS ENCOUNTERED IN WATER DEPOSITS *Paper by J A Holmes and O A Walker, presented at Annual Meeting of ASTM, Pittsburgh, June* 28 *to July* 2, 1943. *Issued by National Aluminate Corp.* 6216 *W* 66*th Pl, Chicago* 38, *Ill. Write direct for free copy.* Authors consider some of the problems encountered when investigating samples of scale and review methods employed to identify scale components. These methods include chemical analysis, microscopic examination, petrographic examination and X-ray diffraction, giving applications, limitations and advantages of each.

CLASSIFIED DIRECTORY (*Eighth Edition*, 1944) *Issued by Association of Consulting Chemists and Chemical Engineers, Inc.* 50 *E* 41*st St, New York, N. Y.* 96 *pages*, 8½x10¾. *Free on request to Association, giving source of reference.* The three sections are: (1) *Key sheet*—record of various services by members. Numerical index precedes key sheet listings. (2) *Scope sheets*—one-page statements from each member, descriptive of his and his organization's qualifications, scope, functions and activities. (3) *Index*—in alphabetical order, membership list, company affiliation and geographical location of members.

GUIDE TO WELDABILITY OF STEELS *Pub by American Welding Society*, 33 *W* 39*th St, New York* 18, *N. Y.* 89 *pages*, 6x9. $1. This book covers a proposed system of determining effect of welding procedure on the ductility of heated zone next to the weld in plain carbon and alloy steels.

THE SECOND MILE—A RESURVEY (1944) *By William E Wickenden, President, Case School of Applied Science. Issued by Engineers' Council for Professional Development*, 29 *West* 39*th St, New York* 18, *N. Y.* 16 *pages*, $3 *per hundred*, 5¢ *a copy in small lots and* 10¢ *for single copies.* ECPD edition of *The Second Mile* was shortened, style modified and a section, "Does an Engineer Need His Profession?" was added. New material is pertinent to all engineers in the present confusion as to professional status.

FASTENERS (*Vol I, No. 1*) *Pub by American Institute of Bolt, Nut and Rivet Mfrs.* 1550 *Hanna Bldg, Cleveland* 15, *Ohio.* 24 *pages*, 8½x11. *Free on request to Institute.* First number includes: "The Rolled Screw Thread Process Opens Bottlenecks," George S Case, The Lamson and Sessions Co: "Cold Driving of Large Rivets," W E Fowler, Jr.

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For 6" scale with pipe diameter marking, write Department 89-K7.

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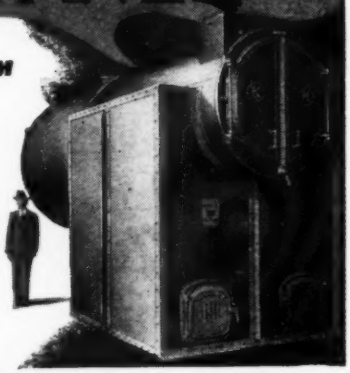

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PYREX HIGH PRESSURE

for use where Temperature Changes are Extreme

You can't use just any Gauge Glass where thermal shock may be encountered—and expect it to stand up. PYREX High Pressure Gauge Glasses are built to withstand sudden temperature changes. In a routine test at Corning, they are heated to 425° F. and plunged into ice water.

They have an exceptionally long life and retain their original crystal clearness, because the special borosilicate glass from which they are made resists the solvent action of steam and hot water. The hard, smooth surface resists scratching.

Because PYREX brand Gauge Glasses are made with machine drawn accuracy, they fit right—there's very little possibility of installation strains.

Pick the one Gauge Glass best suited for your particular requirements from the complete CORNING and PYREX line. Write for Bulletin 817; it tells the whole story on all these glasses and helps you select the right glass for your service.

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Riveting Apparatus, Inc; "How Tight Should a Bolt Be?" J O Almen, Research Laboratories, General Motors. In "Fasteners Digest," industrial publications report on bolts, nuts, rivets, screws, etc. Photos show technical-research facilities of American Institute of Bolt, Nut and Rivet Mfrs at Technological Institute of Northwestern University.

MECHANICAL WORLD YEAR BOOK (1944) *Pub by Emmott & Co, Ltd, 78 Palantine Road, Manchester, 20, England.* 360 *pages,* 4x6, *illustrated, tables, fabroid binding.* 60¢. This annual deals in a practical way with subjects that interest engineers. Included are: light alloys, plastics, ball and roller bearings, steam boilers and their auxiliaries, electric arc welding, gears, rope drives, internal-combustion engines, steam turbines and piping. For those interested in British practice, this little book will be useful.

SINGLE-STAGE AND MULTI-STAGE MECHANICAL DRIVE STEAM TURBINES (*Recommended Standards*) *Pub No.* 43-88 *Issued by Natl Electrical Mfrs Assn,* 155 *E 44th St, New York City.* 12 *pages,* 8½x10, 50¢. A new reference manual with standards for: Nomenclature; Basis of Ratings; Pressure and temperature standards; Turbine load capacities; Overspeed protective devices; Relief valves for turbine discharge connections; Speed governed by external devices; Standard features and accessories. For consulting engineers, manufacturers and users of these turbines.

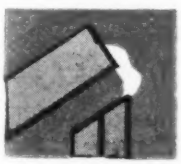
VULCANIZED FIBRE STANDARDS, *Pub No.* 43-87 *Issued by Natl Electrical Mfrs Assn,* 155 *E 44th St, New York City,* 12 *pages,* 8½x10, 25¢. All standards dealing with manufacture and test of vulcanized fiber that have been adopted are contained in this new edition which supersedes Pub No. 38-51 (1938). Included are: Description and standard grades; Standard colors of sheets, tubes and rods; Dimensions of sheets, blocks, rods and tubes; Standards for physical, electrical and chemical properties.

APPLICATION OF OVERFIRE JETS (1944) *By Richard B Engdahl. Technical report No.* 7 *by Bituminous Coal Research, Inc, and Fuel Research Laboratories, Battelle Memorial Institute,* 14 *pages,* 9x6. *On request from Battelle Memorial Institute,* 505 *King Ave, Columbus* 1, *Ohio.* Contents include: Jets not a cure-all, construction of steam jets, selecting proper size, changing amount of air, where no air is needed, fan jets, silencing jets, flue-gas jets, piping.

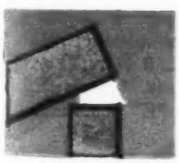
THE HYDROGENATION OF COAL AT HIGH TEMPERATURES *By J L Bray, Head, School of Chemical and Metallurgical Engrg and R E Howard, Instructor in Chemical Engrg, Purdue Univ. Published by The Engineering Experiment Station, Purdue Univ, Lafayette, Ind.* 55 *pages, paper cover. Limited number of copies available free.* First of a series of reports dealing with hydrogenation of coal, this bulletin covers investigation of hydrogenation of Indiana fourth-seam coal, without use of vehicles or catalysts, in temperature range from 750 to

arcs leave this point Fast!

A POINT TO REMEMBER!



LIKE THIS. Diamond-pointed break jaws confine arcing to the point . . . force the arc to break outside the current carrying area. Contact surfaces stay clean . . . don't pit, don't burn.



NOT LIKE THIS. When ordinary safety switches are opened, the arc leaps across the contact areas . . . along the jaws and blade. It hangs on longer, burns and pits the contact surfaces.

When arcs hang fire, switch contacts become pitted and burnt . . . cause trouble. To avoid this, keep the arc away from the contact area—*and* put it out *quick!*

Westinghouse Safety Switches do *both.* The diamond-pointed jaw forces the arc to break outside the current-carrying area. Contacts stay clean, last longer, need less care, provide better protection.

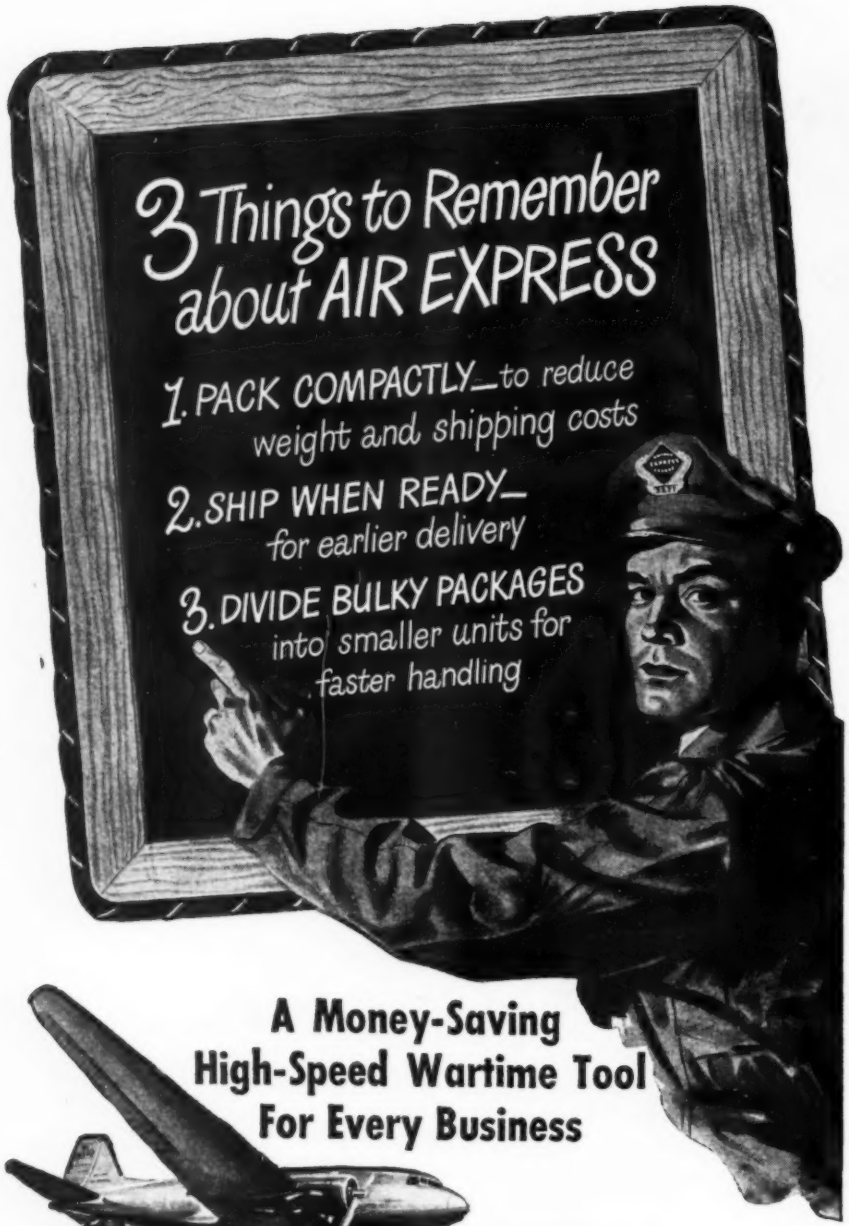
For 575 or 600-volt circuits, Westinghouse provides extra protection—the exclusive "De-ion" arc quencher. Arcs are drawn into the grid chamber—divided—quenched quickly!

Protect circuits with Westinghouse Safety Switches. Ratings up to 1200 amps, 600 volts. Call your Westinghouse Representative today. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Dept. 7-N.

J-21299

Westinghouse SAFETY SWITCHES

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE


3 Things to Remember about AIR EXPRESS
1. PACK COMPACTLY—to reduce weight and shipping costs
2. SHIP WHEN READY—for earlier delivery
3. DIVIDE BULKY PACKAGES into smaller units for faster handling

A Money-Saving High-Speed Wartime Tool For Every Business

As a result of increased efficiency developed to meet wartime demands, rates have been reduced. Shippers nationwide are now saving an average of more than 10% on AIR EXPRESS charges. And AIR EXPRESS schedules are based on "hours", not days and weeks—with 3-mile-a-minute service direct to hundreds of U.S. cities and scores of foreign countries.

WRITE TODAY for "Vision Unlimited"—an informative booklet that will stimulate the thinking of every executive. Dept. PR-7, Railway Express Agency, 230 Park Avenue, New York 17, N. Y., or ask for it at any local office.

AIR EXPRESS
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1060 F, with special emphasis on production of gaseous fuel. Data are given for the variations of gas composition with time for various temperatures, and the equilibrium values of gas composition are determined.

QUESTIONS AND ANSWERS ON THE USE OF FUEL OILS FOR THE DUSTLESS TREATMENT OF COAL *Prepared by Research Laboratories of Battelle Memorial Institute. Published by Bituminous Coal Research, Inc, 803 Southern Building, Washington, D. C. 6 pages, mimeographed, paper cover. Available on request.* Following the general lines of a previous bulletin on use of calcium chloride for dustless treatment, this publication shows how available oils differ from prewar coal-spray oils, discusses the significance of viscosity, flashpoint, and pour point, outlines the methods of treatment and cites the various special considerations involved.

FLOW OF WATER THROUGH SMALL SWING-CHECK VALVES *By F W Greve, Prof of Hydraulic Engrg, Purdue Univ. Published by The Engineering Experiment Station, Purdue Univ, Lafayette, Ind. 20 pages, paper cover. Limited number of copies available free.* Describes test procedure and gives results of investigation of head loss in 0.5 to 2.0-in. swing-check valves. Curves show relation of head loss to flow velocity, Reynolds number and relation of flow velocity to Reynolds number for 2-in. valve. Tables give data on each valve tested.

D W Russell, pres, Airtemp div, Chrysler Corp, was elected pres, **Air Conditioning and Refrigerating Machinery Assn, Inc,** at its annual meeting. Other officers are: S E Lauer, York Corp, first vice-pres; F S McNeal, Universal Cooler Corp, second vice-pres; P A McKittrick, Parks-Cramer Co, treas. Elected to chairmanship of the board of directors was C E Wilson, vice-pres, Worthington Pump & Machinery.

CURRENT AWARDS

These companies have been singled out for **Army-Navy "E"** awards: Industrial Gear Mfg Co; General Controls Co.

White stars (Army-Navy "E" renewals) to: C H Wheeler Mfg. Co, 1 star; Craftsweld Equipment Corp, 1 star; John Reiner & Co, 2 stars; George D Roper Corp, 2 stars; Sylvania Elec Products, Inc, radio div, Emporium, Pa., 3 stars; Farrel-Birmingham Co's 3 plants, 4 stars; Nordberg Mfg Co, 4 stars on "E" pennant and 3 on "M" pennant.

Gold stars (U. S. Maritime Commission) to: General Elec Co's Lynn, Mass., River Works; Kennedy Valve Mfg. Co; Crocker-Wheeler Elec Mfg Co, div of Joshua Hendy Iron Works.

National Security Award to: Philco Corp, for observance of security and protection regulations of U. S. Army.

Meritorious Civilian Service Award from Navy Dept, bureau of yards and docks, to: Wirth J Olsen, combustion safety engr, for construction services at U. S. Naval Air Training Center, Pensacola.

HYDROIL
THE ANCHOR PACKING CO.
Water, Gasoline and Oils up to 1000 LBS. pressure—For use on Hot or Cold Water, Gasoline and Oils

METALLIC AND FIBROUS PACKINGS FOR EVERY PURPOSE

THE ANCHOR PACKING COMPANY

GENERAL OFFICES: PHILADELPHIA 8, PA.

FACTORIES: MANHEIM, PA., ELKHART, IND., MONTREAL, CAN.

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Baltimore 2, Maryland	106 Stewart Bldg., Gay and Lombard Streets
Boston 14, Massachusetts	303-04 North Station Building 150 Causeway Street
Buffalo 2, New York	Andrews Building
Cleveland 13, Ohio	523-25-27 Rockefeller Building
Columbus 9, Ohio	172 North Cassingham Road
Chicago 11, Illinois	200 East Illinois Street
Cincinnati 2, Ohio	4 West 7th Street
Detroit 26, Michigan	169 West Jefferson Avenue
Houston 2, Texas	509 Washington Avenue
Kansas City 6, Missouri	1332 Oak Street
Los Angeles 21, California	720 Mateo Street
Montreal, Canada	5575 Cote Saint Paul Road
Milwaukee 2, Wisconsin	4417 West North Avenue
New Orleans 4, Louisiana	418 Common Street
New York 13, New York	100 Sixth Avenue, near Canal
Philadelphia 8, Pennsylvania	401 North Broad Street
Pittsburgh 22, Pennsylvania	405 Penn Avenue
Portland 5, Oregon	Terminal Sales Building
San Francisco 7, California	156 South Park
Seattle 4, Washington	2207 First Avenue, South
St. Louis 3, Missouri	1407 Pine Street
Tulsa 4, Oklahoma	823 South Gary Place
Wilmington, California	207 Avalon Boulevard

THE ANCHOR PACKING CO. TRADE A MARK

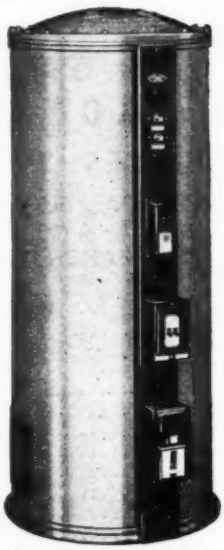
HONAN-CRANE "CONTINUOUS" OIL PURIFIERS
WILL KEEP TURBINE OIL*COLOR CLEAR AND ACID FREE

When you buy Turbine oil it is delivered to you color clear and at the peak of its lubricating efficiency. Failure of Oil Purification Equipment to maintain that original efficiency threatens the safety of the oil and causes Turbine trouble ranging from operating inefficiency to complete failure, resulting in disasterous repair costs.

The superior efficiency of Honan-Crane Purifiers insures the complete removal of all non-lubricating contamination from Turbine oils. You can institute a program of purification which will remove the smallest abrasives, give you positive control over acids and allow you to keep the steam emulsion number well within safe operating limits.

*(Unretouched photograph shows dirty Turbine oil in pencil bottle at left, same oil after being purified in bottle at right.)

Fill in coupon below for complete specifications and engineering bulletin on the purification of Turbine and Hydro-Electric Generator oils.



HONAN-CRANE "CONTINUOUS" OIL PURIFIER

HONAN-CRANE CORP.
1200 SIXTH AVENUE, LEBANON, INDIANA
Please send complete information on Turbine oils.

Name.....

Company.....

City.....Zone.....

State.....

Power News

(*Continued from page* 130)

months, Director Falck, Office of War Utilities, told members of the Land Steam Turbine and Turbine Generator Industry Advisory Committee.

Projects will be approved only when the need for additional generating capacity may be clearly demonstrated—at least so long as the manpower situation and recent downward revisions of estimates of the availability of certain materials remain unchanged.

Members reported that the turbine industry is operating at capacity in most lines although considerable capacity is available for turbine production for delivery after Jan 1. New requirements are "sizable."

Drafting of men under 26 has seriously curtailed production, and similar policies applied to men over 26 would severely curtail production.

Lubrication Plan

This complete "Save and Serve" campaign stresses proper lubrication as the basis for all maintenance. Included are the following:

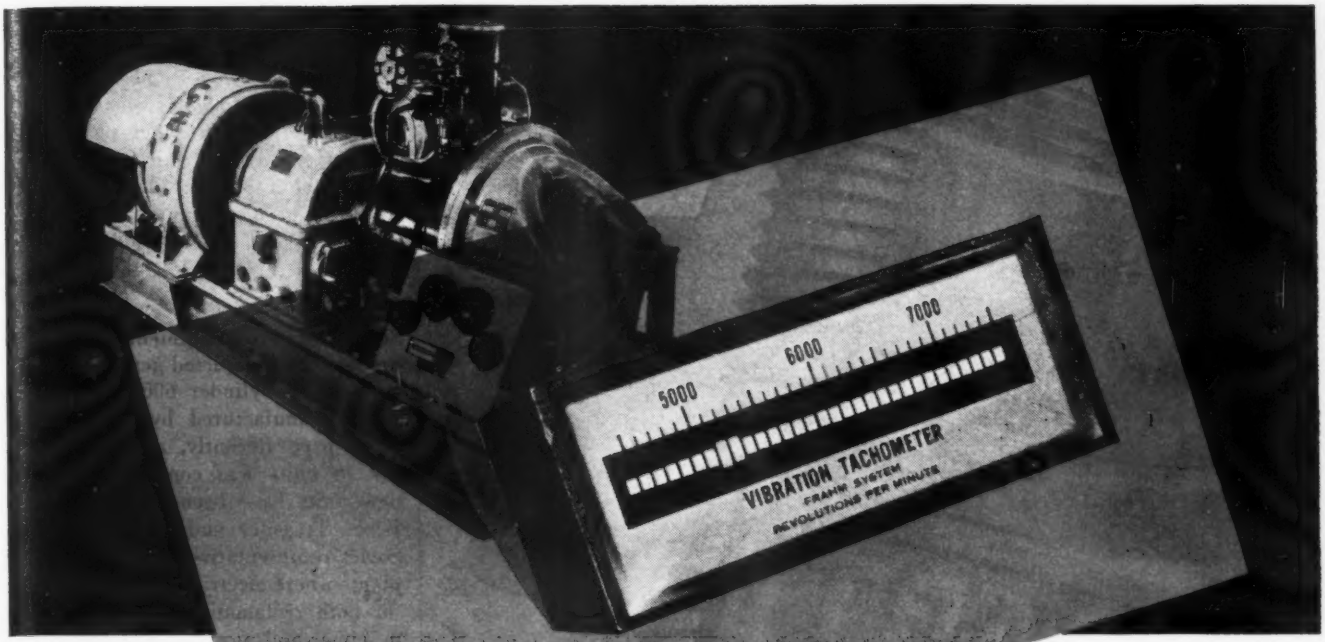
Poster (center rear): Save and Serve

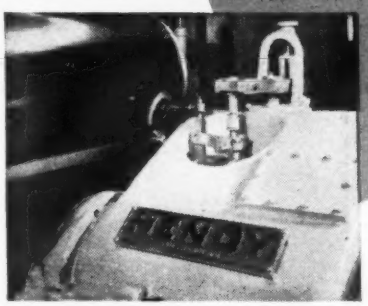
Wall chart (top left) containing key points on lubrication

Basic booklet (center) on do's and don'ts of industrial lubrication and handling of petroleum products

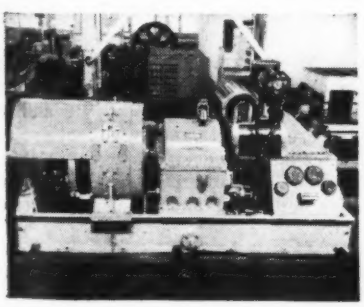
Series of industry folders (center): mine, refrigeration, diesel, rubber, etc., giving actual case histories of savings from proper lubrication

Technical bulletins (left and right) giving engineering information on the ap-





The simplicity of the Hendy governor is shown in this view. Power unit for the governor is an integral portion of the reduction gear assembly.



Over-all view of the 300 kw, 220/440-volt Hendy Turbo-generator, showing the sturdy welded steel bedplate and the compact arrangement of the complete set.

RIGHT ON THE NOSE

AT 5250 R.P.M.

Two important factors are brought out by that statement . . . first, Hendy Turbo-generator governors *hold* speed accurately regardless of load fluctuations; second, Hendy engineers, in their search for new and improved methods and materials, have made another valuable contribution to the operating efficiency of power-producing machinery.

The governor on Hendy turbines is greatly simplified over former types, requires no stuffing boxes or soft packing, utilizes anti-friction bearings in the linkages, and is enclosed within the gear-case. Individually, none of these new practices would materially affect closer speed regulation—but together, and combined with precise workmanship, they assure fine speed control over the entire range of no-load to overload conditions—resulting in uniform generator performance.

Hendy Turbo-generators are available for a-c or d-c output—from 250 to 750 kw capacity. Inquiries are invited on these standardized units—as well as on larger plants that will be available in the near future. Write for new booklet which gives more complete information.

JOSHUA HENDY Division

JOSHUA HENDY IRON WORKS

SUNNYVALE, CALIFORNIA

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EST. 1856

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • ST. LOUIS • WASHINGTON • LOS ANGELES

Matched-Ground Bronze Seats give Dart Unions Longer Life

Here's why Dart Unions give you years of good service: Dart's matched bronze seats, precision machined and ground to accurate "true-ball" surfaces make it possible for Darts to be used *again and again.*

Dart's tough Nuts and Bodies, made of heavy air refined malleable iron gives Darts their ability to resist rough handling and pipe strains.

That's why so many plants are looking for their old Darts . . . and putting them back on the job. In case you can't find any Darts around your shop, see your supplier for *new* Darts. . . . . .

DART UNIONS

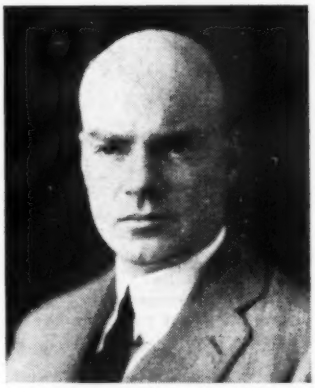
DART UNIONS LIVE LONGER

E. M. DART MFG. CO., Providence, R. I.

plication of lubricants—general industrial equipment, air compressors, hydraulic installations, and refrigeration *Series of maintenance memos* to be mailed to key personnel periodically.

Prepared by the Sun Oil Company, Philadelphia 3, Pa., the campaign is available to any industrial company on request. For coupon, see POWER New Bulletin dept, page 168, this issue.

Scheduled for shipment to Russia are 24 more completed generating units, type JSD 8-cylinder 600-hp diesel engines, manufactured by Cooper-Bessemer Corp. Recently, another contract for 26 units was completed. The 24 new units have been accepted by the U. S. Treasury and approved by the Soviet representative, for use as power plants where electrical energy is needed for both reclamation and normal uses in cities and towns recovered by the advancing Red Army.



James W. Parker

James W Parker is the newly elected president of **Detroit Edison Co.** He has been with the company since 1910 and in addition to the presidency will continue as a director and as general manager. Alfred C Marshall, retiring president, will continue as a director and as an active consultant.

Northwest's vast "mystery load," the nature of which is unknown even to the men who supply the power, was discussed publicly for the first time on the floor of the House by Rep Homer D Angell, Oregon Republican, who estimated that "it will consume more power than presently used in the environs of Portland, representing a population of around half a million."

Angell said he could say "with propriety" that the load "represents a new weapon of warfare, developed by new manufacturing processes that will turn large volumes of electricity into the most important projectiles yet developed." He told the House to beware of cutting appropriations for the Bonneville Power Adm, which serves the load, lest manufacture of the new weapon be endangered.

(*Continued on page* 174)

We've said it for Years—War Housing Projects have proved it—

CENTRAL HEATING IS THE IDEAL SYSTEM FOR THE MODERN COMMUNITY

Mark up another contribution of the war toward better living in the future! Intelligent post-war community planning now fully recognizes the advantages of central heating: making it possible to purchase heat as a commodity like gas, electricity, or city water—*at savings of 15% or more:* A powerful impetus has been given to this movement by the experience of central heating in war housing developments. The Elizabeth Park Housing Project in Akron, illustrated above, is a case in point.

Ric-wiL Conduit Connects Dwellings to City Steam Mains 2000 feet away

This project, comprising 276 family units is heated by steam supplied by Ohio Edison Company, Akron, Ohio utility. In addition to the 2000 feet of Ric-wiL Insulated Pipe Units connecting the project to the city mains, another 7000 feet are used for steam, return and hot water lines on the project itself. Conduit was furnished complete with prefabricated field accessories and installed in record time—with minimum interference with other construction. The completed piping system is efficient, dependable and maintenance-free, enabling the utility to serve the project with steam at rates considerably under the cost of individual heating plants.

Welded into a single piece 700 feet long, this pipe was lowered into the shallow trench beside it . . . a section of the 2000 foot connection to the city main.

Any Community Can Enjoy These Advantages

- Savings of 15% or better in overall fuel consumption.
- Elimination of furnace or boiler tending by consumer.
- Promotes cleanliness in buildings heated.
- Provides extra rooms in building basements.
- Decreases fire and explosion hazard.
- Reduces smoke and soot . . . provides cleaner, healthier community.
- Eliminates private coal delivery and ash removal.
- Gives uniform, clean heat quickly, whenever needed.

For information about Ric-wiL Conduit for central heat distribution get in touch with your nearest Ric-wiL agent or write to us direct.

RIC-WIL INSULATED PIPE CONDUIT SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

C. M. H. Stainless Steel BELLOWS Are Standard Production Items

C. M. H. Stainless Steel BELLOWS are standard production products; hence, shipping delays are minimized. All the advantages of *Stainless Steel* have been utilized in the art and craftsmanship of C. M. H. BELLOWS. They are the solution to both difficult and urgent requirements.

C. M. H. Stainless Steel BELLOWS are corrosion resistant and operate efficiently at either high or low temperatures. They have the qualities required for handling high pressures—which may be further increased by multiple ply construction, where needed. Ferrous fittings attached by circular seam welding, give uni-metal assembly and assure non-corrosion of the assembled parts.

C. M. H. engineers and production will help you solve your immediate bellows problems—where they are to be required for valve stem housing on vacuum equipment, thermostats, pressure controls, valves, recording instruments, hydraulic mechanisms, rotating shaft seals, or other purposes. Write for complete information today.

Ask for Chicago Metal Hose Engineering Take-off Form SSB2 on which to submit your bellows requirements. It will save you time — assure more accurate, expeditious handling.

Flexible Metal Hose for Every Industrial Use

CMH CHICAGO METAL HOSE CORPORATION
MAYWOOD, ILLINOIS

Plants: Maywood and Elgin, Ill.

Dissolved Oxygen

(*Continued from page* 81)

When dissolved oxygen is present in the interference sample this condition appears not to exist and the recorded oxygen value may be considered to be in close agreement with the actual amount present in the sample.

The author acknowledges material assistance in obtaining data necessary for evaluating the reliabliity of the described test procedure from members of the Experimental, and the Condenser and Heater Divisions of Worthington Pump and Machinery Corp. In addition, access to the facilities of several cooperating utility companies aided in obtaining much of the data required.

REFERENCES

E J Theriault, *U. S. Public Health Bulletin No.* 173, 1931

J D Yoder and A C Dresher, "The Winkler Test for Determining Oxygen in Boiler Feedwater," *Combustion,* Vol 5 No. 10, pp 18 - 22, 1934

M C Schwartz, *Dissolved Oxygen in Boiler Feedwater,* Louisiana State University Press, Baton Rouge, La., 1935

Alfred H White, Claude H Leland and Dale W Button, *Determination of Dissolved Oxygen in Boiler Feedwater,* Project No. 767 for Joint Research Committee on Boiler Feedwater Studies, Oct, 1937

G A Perley, "Determination of Dissolved Oxygen in Aqueous Solutions," *Industrial and Engineering Chemistry,* Vol 2, p 240, May 15, 1939

Robert C Adams, Robert E Barnett and Daniel E Keller, Jr, *Field and Laboratory Determination of Dissolved Oxygen,* ASTM, 90, 1943 preprint

Stevenson Assn Celebrates Golden Anniversary

Stevenson Assn, No. 44, New York National Assn of Power Engineers, celebrated its golden anniversary with a dinner-dance at the Henry Hudson Hotel, New York City, May 20, 1944. Present membership of No. 44 is more than 400, and includes the chief engineers of many of the leading skyscrapers and institutions of New York City, but eight men formed the charter group on May 19, 1884.

The Association has always pioneered education and license legislation. Years ago it played a leading part in the formation of the General Committee of greater New York, which sponsored lectures and debates, and conducted efficiency tests in the steam plants of the city.

Stevenson Assn has cradled many engineering leaders, some of whom rose to high office in the state and national associations. Their voices were always heard in the interests of the engineer and of the public.

YES, your old friend the G.T.M. — Goodyear Technical Man — has a real 1944 solution to water suction hose failure.

It's Goodyear Style M Smooth Bore Water Suction Hose — a strong, sturdily built hose for all-round service that drinks it up in hard going.

In most water suction operations, there are particles of sand, grit, and other abrasive substances suspended in the water, which may cause early tube failure.

Style M Smooth Bore has a tube compounded to resist the abrasive action of suspended particles; and, in addition, it protects the wire reinforcement from corrosion by alkaline or slightly acid water.

Note its unique features in the blueprint at the right. This construction, time-proved over many years, is further advantaged by Goodyear's twenty years' experience in synthetic rubber that assures the highest-quality compounds.

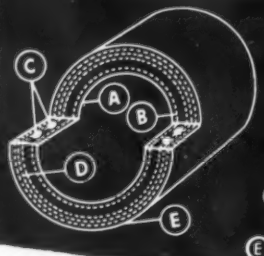
You will find all Goodyear industrial rubber products equally superior — because Goodyear has the "know-how" in synthetics to build them better — and because they are correctly specified by the G.T.M. To bring him to your office, phone the nearest Goodyear Industrial Rubber Goods Distributor.

GOODYEAR INDUSTRIAL RUBBER PRODUCTS

GTM-Specified

STYLE M WATER SUCTION HOSE

(Smooth Bore) for Heavy-Duty Service



(A)-Tough tube, resistant to abrasion, acids and alkalis

(B)-Close-woven fabric ply for extra burst resistance

(C)-High tensile steel wire helix prevents collapse under suction; increases resistance to bursting, crushing and kinking

(D)-Multiple fabric plies add extra strength against bursts and end pull

(E)-Heavy cover protects against abrasion and cutting

GOODYEAR

THE GREATEST NAME IN RUBBER

Let's all Back the Attack with War Bonds

These NEW Catalogs, Booklets and Bulletins Are Yours for the Asking!

AIR CONDITIONING, HEATING, REFRIGERATION AND VENTILATING

1 **CENTRAL HEATING** — Ric-wiL Co, 1572 Union Commerce Bldg, Cleveland, Ohio. 6-page bulletin No. FM4402 points out advantages of central heating in post-war community or group planning.

2 **ROOF VENTILATOR** — Powermatic Ventilator Co, 4019 Prospect Ave, Cleveland 3, Ohio. Folder describes new design of *Iron Lung*, a power roof ventilator which removes fumes, gases, steam, smoke and excessive heat from buildings.

3 **REFRIGERANT PURGERS** — Armstrong Machine Works, Three Rivers, Mich. 8-page bulletin No. 160 discusses non-condensable gases, causes of high condenser pressures, purging methods, etc, and gives complete data on Armstrong purgers, with specifications and prices.

4 **REFRIGERATION COMPRESSORS** — Worthington Pump & Machinery Corp, Harrison, N. J. 6-page bulletin No. C-1100-B18, contains specifications of Worthington Type VSA vertical two-cylinder single-acting inclosed refrigeration compressors, in 8x8-in., 9x9-in. and 10x10-in. sizes. 6-page bulletin No. C-1100-B19 covers same compressors in 6x6-in. and 7x7-in. sizes.

BOILERS AND AUXILIARIES

5 **BOILER INSULATION** — Airproofit Co, 110 S Dearborn St, Chicago 3, Ill. Single page bulletin discusses savings effected by coating boiler settings with *Airproofit*, a plastic insulation for brick-set boilers, and gives reasons for sealing boiler settings against air leaks. Bulletin No. 22544SOS tells how to increase heating plant efficiency.

6 **CONTROLLED-FLOW DAMPERS** — Thermix Engrg Co, Greenwich, Conn. 12-page catalog provides data on industrial damper problems. Case histories and diagrams show how proper damper installations have resulted in increased efficiencies on a wide variety of applications.

7 **BAFFLE AND FURNACE MODERNIZATION**—Ramtite Co, 2563 W 18th St, Chicago 8, Ill. Bulletin, entitled "Economy Boiler Baffles," explains how to economize by proper design. It presents blueprints showing old and new baffle location, together with savings made in each case.

8 **PRESSURE VESSELS** — Union Iron Works, Erie, Pa. 8-page booklet No. 117, entitled "Pressure Vessels and Fabricated Steel," discusses construction and inspection of Union pressure vessels.

9 **WATERTUBE BOILERS** — Bigelow Co, New Haven 3, Conn. 16-page catalog shows applications of Bigelow steam generating units. Capacities, pressures and firing methods of each design are included.

CONTROLS, ELECTRIC

10 **PHOTOELECTRIC CONTROL** — Photoswitch, Inc, 77 Broadway, Cambridge 42, Mass. 4-page bulletin No. 316 describes Photoswitch Densitometer Series D90, a recently introduced photoelectric control for transparency measurement of liquids, gases, films, filters, plastics, etc.

11 **ELECTRONIC RELAY** — General Electric Co, Schenectady, N. Y. 8-page bulletin No. GEA-4214 gives description, operation and application of CR-7511-A electronic relay.

12 **ELECTRONIC CONTROLLERS** — Bristol Co, Waterbury 91, Conn. Bulletin No. B220 covers new line of free-vane electronic controllers for automatically controlling temperature, pressure, liquid level and humidity.

ELECTRICAL EQUIPMENT

13 **SWITCHBOARD CONNECTORS** — Cannon Electric Development Co, 3209 Humboldt St, Los Angeles 31, Calif. 12-page bulletin contains data on Cannon laboratory and switchboard connectors and experimental switchboards.

14 **PYRANOL TRANSFORMERS** — General Electric Co, Schenectady, N. Y. 16-page bulletin No. GEA-4193 provides summary of safety and savings gained with all-purpose Pyranol transformer installation.

15 **ELECTRICAL SYMBOLS** — I-T-E Circuit Breaker Co, 19th and Hamilton St, Philadelphia 30, Pa. Chart lists American Standard Symbols for power, control and measurement, both in one-line and complete-wiring diagrams.

16 **FUSE CUTOUTS**—General Electric Co, Schenectady, N. Y. 4-page booklet No. GEA-4224 discusses G-E flip-open fuse cutouts, in ratings of 50 amp, 7500 to 12,500 and 15,000 v.

MAINTENANCE AND SAFETY EQUIPMENT

17 **SAFETY SERVICE**—Underwriters' Laboratories, Inc, 207 E Ohio St, Chicago, Ill. 34-page booklet, entitled "Fifty Years in the Service of Safety," tells about the Underwriters' Laboratories, an organization for safeguarding lives and property from hazards of fire, casualty and crime.

18 **FOLDING LADDER** — Duo-Safety Ladder Corp, Oshkosh, Wis. 4-page folder describes the new G heavy-duty lightweight folding ladder, available in 6- to 20-ft lengths.

19 **OIL PURIFICATION EQUIPMENT** —Honan-Crane Corp, 1200 6th St, Lebanon, Ind. 8-page issue of "On Land and On Sea," Vol 4, No. 2, reviews highlights of current oil shortage and tells how oil purification equipment relieves this shortage.

20 **RATCHET WRENCH** — Greene, Tweed & Co, Bronx Blvd at 238th St, New York 66, N. Y. Bulletin describes principal features of *Favorite* ratchet wrench. Design, application and dimension data are included.

21 **TAP EXTRACTORS** — Walton Co, 94 Allyn St, Hartford 3, Conn. 3 sheets emphasize simplicity of operation, immediate delivery and 48-hr free reconditioning service for Walton tap extractors. Price list is included.

(*Continued on page* 170)

HOW TO ORDER

Be sure to fill out, completely, one coupon for each piece of literature you order. (See sample below.) This gives your request authority and helps the manufacturer to address your copy completely. Readers who fail to prepare request blanks correctly may be disappointed under difficult postal conditions and limited quantities of bulletins available today.

Use as many coupons as you need, but cut them out and send them as one block in an envelope addressed to POWER, 330 W 42nd St, New York 18, N. Y.

Write in circle number of item describing one catalog wanted → (17)

Your Company Name Brown Mfg Co

Address 3718 First Avenue
Pottsville, Oklahoma

Your Name John Smith

Your Title Power Engineer

POWER, 330 West 42nd St., New York

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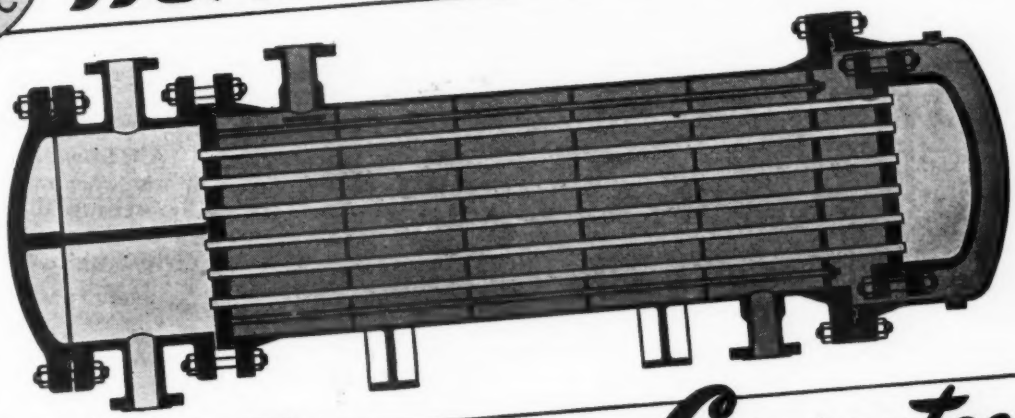
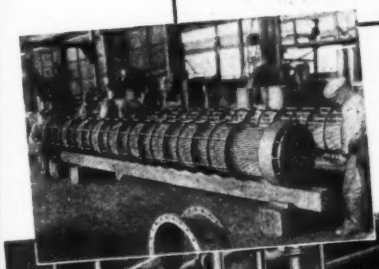
POWER, 330 West 42nd St., New York

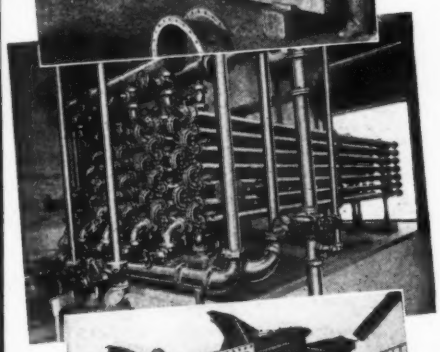
ACME COPPERSMITHING & MACHINE CO.

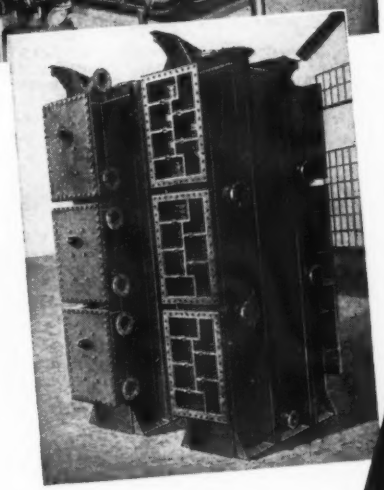
HEAT EXCHANGERS



Performance Guaranteed







Acme Heat Exchangers, covering every type of heat transfer equipment, are designed and engineered to meet specific operating conditions, overcoming fouling and maintenance difficulties at low initial costs. Materials of construction include cast or fabricated Ferrous and Non-Ferrous metals and their alloys.

Types: Tubular, or Plate, with either removable or fixed bundle; U Bend, Multi-Pass, Coil, Fin Tube, Drip, Baudelot, and Forced Circulation.

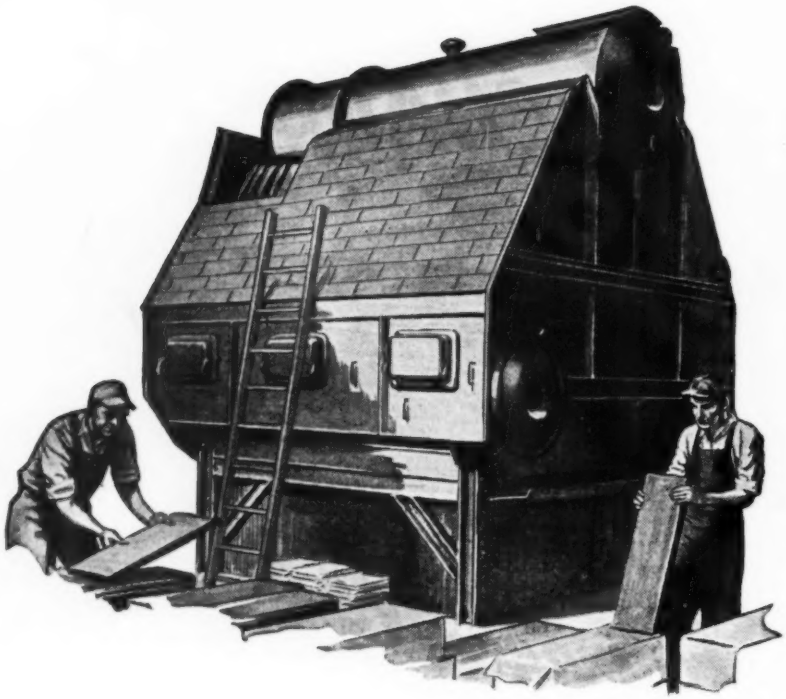
Mechanical Standards: Acme Heat Exchangers are fabricated in accordance with A.S.M.E. Code, A.P.I.—A.S.M.E. Code, or T.E.M.A. Standards.

ACME

Processing Equipment

SPECIAL EQUIPMENT
PILOT PLANTS
COMPLETE PLANTS

ACME COPPERSMITHING & MACHINE CO., ORELAND, PA.



MONO-BLOCK

A One-block Insulation, Effective Over the Full Temperature-Range

Made from *black* rockwool, B-H Mono-block is high-temperature-resistant (up to 1700° F.) and has exceptionally low thermal conductivity. You'll find it lighter, and more efficient, too, because its long, straight fibres are interwoven in layers by an exclusive, patented process. In each block, millions of tiny air-cells hold back the heat, preventing its escape. Because it is a one-block insulation, Mono-block delivers substantial savings in installation costs, too. Send for sample and new bulletin.

Baldwin-Hill Co., 575 Klagg Ave., Trenton 2, New Jersey. Plants in Trenton, New Jersey; Kalamazoo, Michigan; and Huntington, Indiana.

Baldwin-Hill

BH COMPANY

HEAT & COLD INSULATIONS

New Bulletins

(*Continued from page* 168)

22 **FIRE EXTINGUISHERS** — Walter Kidde & Co, 140 Cedar St, New York 6, N. Y. 12-page manual, entitled "Inspection and Maintenance of First Aid Fire Extinguishers," outlines a basic maintenance system, including questions of supervision, record keeping and recharging of all extinguishers.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **PORTABLE ELECTRIC DRILL** — Independent Pneumatic Tool Co, 600 W Jackson Blvd, Chicago 6, Ill. 20-page brochure covers history, development, features and specifications of Thor plastic-housed portable electric drill. Copy sent only to key executives.

23 **CONSTANT-LEVEL OILERS** — Trico Fuse Mfg Co, 2948 N 5th St, Milwaukee 12, Wis. Bulletins No. 24-A and 25-A describe an automatically controlled visible oiling method for ring or ball bearings, shafts, gear and pump housings, etc.

24 **OIL RECLAIMER** — Youngstown Miller Co, Sandusky, Ohio. 4-page bulletin No. YM-700 discusses the new Robot oil reclaimer, in capacities ranging from 4 to 300 gal per hr.

MATERIALS HANDLING

25 **PORTABLE SCRAPER CONVEYOR** —Jeffrey Mfg Co, Columbus 16, Ohio. 6-page bulletin No. 781 contains data on Jeffrey Type 242-A portable scraper conveyor, in 25- 30- and 35-ft lengths, with electric motor or gasoline engine.

26 **ELECTRIC CHAIN HOIST**—Hoist div, Harnischfeger Corp, Milwaukee 14, Wis. 8-page bulletin No. H-23 gives operating and construction details of new 500-lb. Handi-Lift electric chain hoist. Condensed specifications, clearance data and installation photos are included.

27 **PORTABLE CAR UNLOADER** — Jeffrey Mfg Co, Columbus 16, Ohio. 4-page bulletin No. 779 describes the Jeffrey Type 246 portable car unloader, which operates above or below rails.

PIPING, FITTINGS, VALVES AND SPECIALTIES

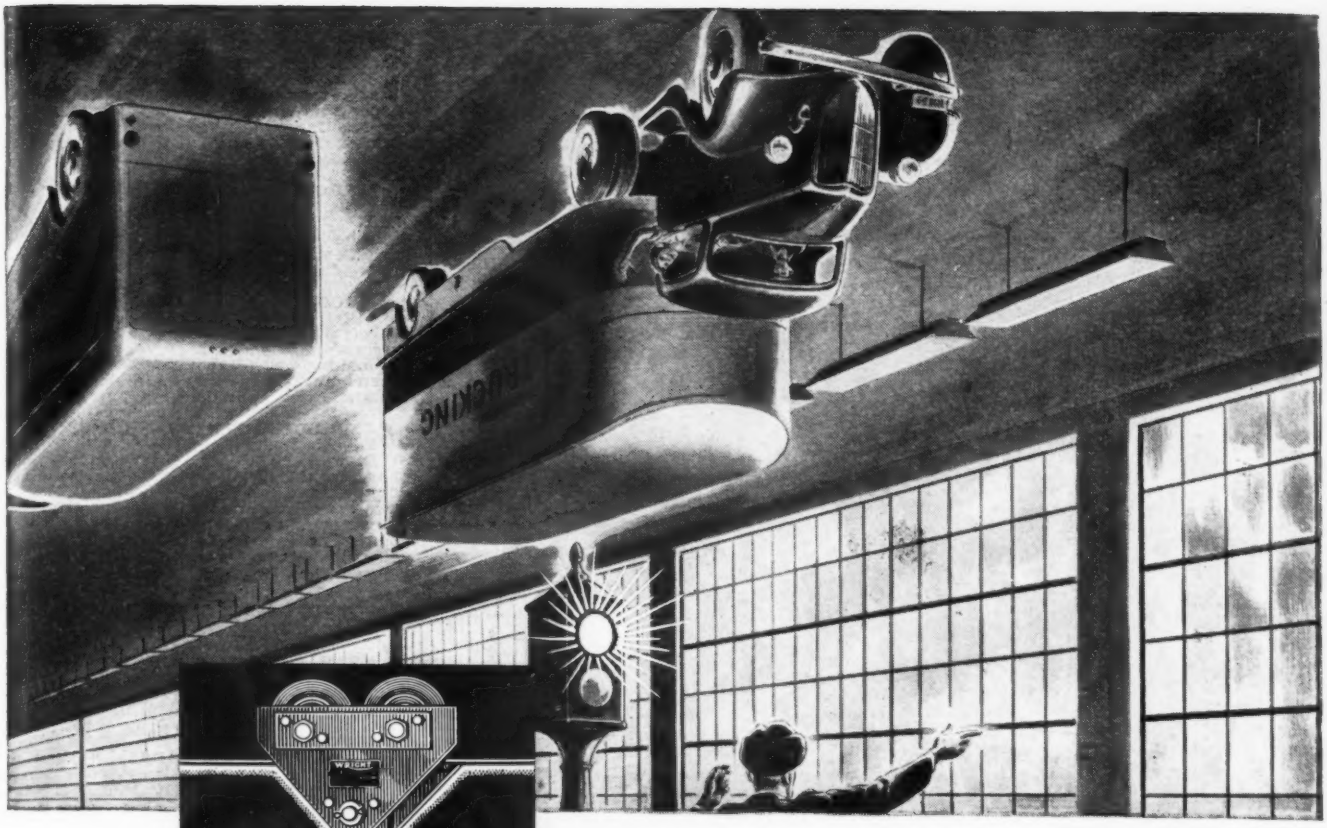
28 **SELF-LUBRICATING VALVE** — Lancaster Valve Co, Lancaster, Ohio. 4-page bulletin describes features of new Waddell self-lubricating plug valve, which is automatically lubricated by piston force with every operation.

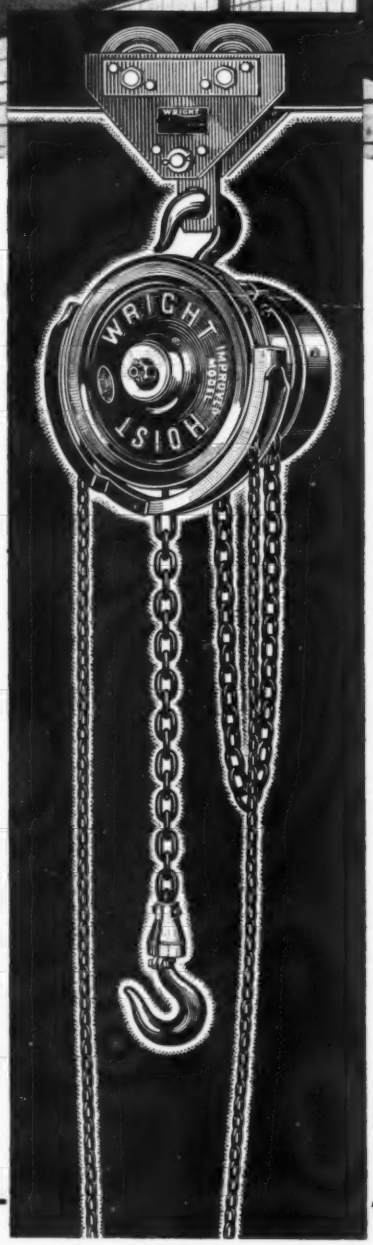
29 **DIGESTER COILS**—A M Byers Co, Pittsburgh, Pa. Bulletin, entitled "Wrought Iron for Sewage Treatment and Disposal Installations," gives helpful tips on how engineers are solving, or avoiding, maintenance problems.

30 **INSULATED PIPE UNITS**—Ric-wiL Co, 1572 Union Commerce Bldg, Cleveland, Ohio. 6-page booklet No. 4404 presents the latest improvements in Ric-wiL insulated pipe units.

31 **TUBE CLEANERS** — Elliott Co, Springfield, Ohio. 32-page bulletin No. Y-18 condenses and details the entire field of modern practice in tube cleaning. Booklet contains many equipment photographs and charts.

32 **AIR INLET VALVES** — Simplex Valve & Meter Co, 6780 Upland St, Philadelphia 42, Pa. 16-page bulletin No. 125 contains design, construction and operation data of Simplex air inlet valves, installed on thin-walled gravity flow lines to eliminate possibility of collapse as a result of sudden drops in pipeline pressure.





WRIGHT MAKES HIGHWAYS OF THE SKYWAYS OF YOUR PLANT

WRIGHT engineers (and **WRIGHT** Hoists and Cranes) convert idle ceilings into production boulevards. **WRIGHT** Improved High Speed Hoists, **WRIGHT** *Speedway* Electric Hoists, and **WRIGHT** Cranes have long made possible fast, safe, economical, horizontal and vertical transportation of materials.

Your local **WRIGHT** distributor is well qualified to suggest methods for both speeding production and saving money. You will find him listed in your metropolitan classified telephone directory. If your problem is special, ask your distributor to call a **WRIGHT** engineer, who has had years of experience in solving material handling problems.

WRIGHT MANUFACTURING DIVISION

York, Pa., Chicago, Denver, Los Angeles, San Francisco, Portland, New York

AMERICAN CHAIN & CABLE COMPANY, INC.

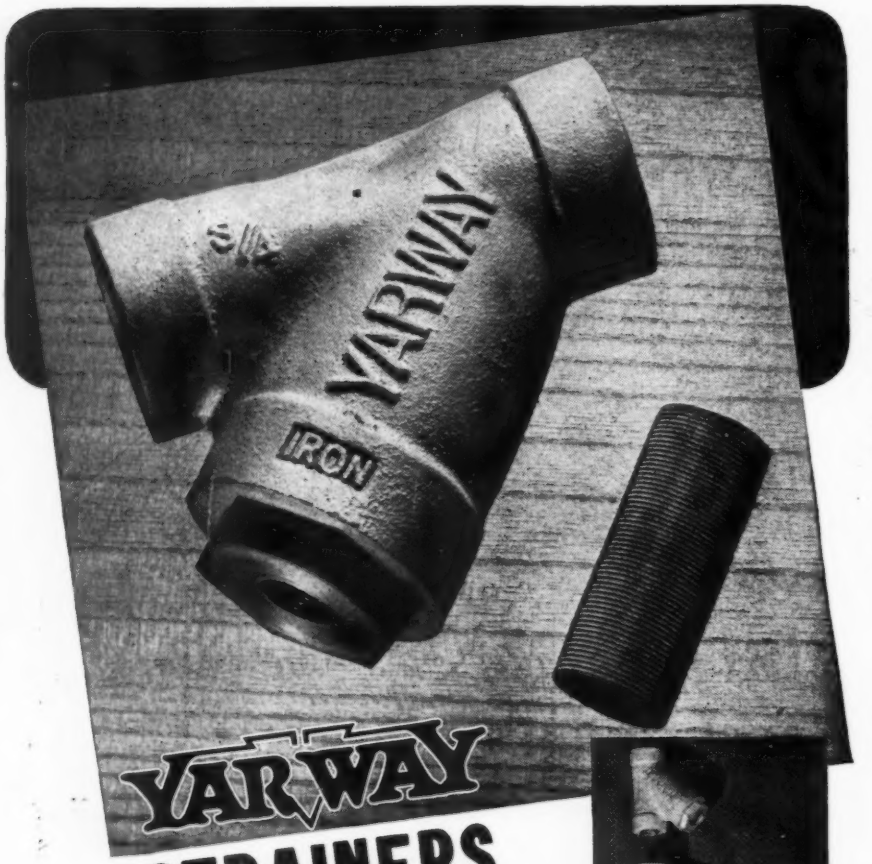
BRIDGEPORT · CONNECTICUT

ACCO

In Business for Your Safety

ARMY E NAVY

FLYING OVER THE WRIGHT HOIST PLANT



YARWAY

STRAINERS

"Police the Pipelines"

YARWAY STRAINERS are *selling by the thousands* because they are better engineered for the service.

"*The Screen is the Thing*"—a high-grade, woven Monel wire screen that stops the dirt, lets fluids flow freely.

Then, too, purchasers like the *body finish—Cadmium plating inside and out* for protection against corrosion.

And last but not least, it is "*Easy to Clean*" having a steel blow-off bushing, precision machined with straight thread. Screen and bushing come out together—go back together, automatically aligning.

Six sizes, ½" to 2" for pressures up to 600 lb serve practically all strainer needs.

Sold by over 100 Mill Supply Houses. See your Supply House or write for Bulletin S-200.

YARNALL-WARING COMPANY
100 Mermaid Avenue PHILADELPHIA 18, PA.

YARWAY STRAINERS

WELDING

33 RESISTANCE WELDING—General Electric Co, Schenectady, N. Y. 28-page booklet No. GET-1189 covers resistance-welding methods and equipment, proper equipment selection for best welding results, welding electrodes and their maintenance, material and its preparation for welding.

34 ARC-WELDING ACCESSORIES — General Electric Co, Schenectady, N. Y. 36-page bulletin No. GEA-2704C describes more than 100 of the most important arc-welding accessory items for arc-welding operators.

35 ROCKER-ARM WELDER—Progressive Welder Co, 3050 E Outer Dr, Detroit 12, Mich. Bulletin No. 103 discusses company's new rocker-arm welder for making 500 to 1000 spot welds per hr on structural sections of aluminum ranging up to two ⅛-in. sheets of 24 ST.

36 WELDING SUPPLIES PRICE LIST —Air Reduction Sales Co, 60 E 42nd St, New York 17, N. Y. 20-page pamphlet, entitled "Gas and Electric Welding Supplies and Accessories," gives revised price list of gas welding rods, hard-facing alloys, brazing alloys, fluxes, helmets, goggles, gloves, aprons, welding cable, cable lugs, ground clamps, etc.

OTHER EQUIPMENT

37 COMPRESSED AIR PURIFIER—Bird-White Co, 3119 W Lake St, Chicago, Ill. Single-sheet bulletin No. 10 features the new Pur-O-fier, which operates on a centrifugal principle, utilizing a new high-velocity turbo-rotor.

38 AIR COMPRESSORS — Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y. 36-page catalog No. 1502 discusses compressor and vacuum pumps in sizes from ½ to 10 hp. Bulletin covers Type 30 air-cooled machines with two additions, a 3-stage dual-pressure portable and two 3-stage high-pressure units.

39 COMBUSTION CONTROL — Leeds & Northrup Co, 4907 Stenton Ave, Philadelphia 44, Pa. 16-page catalog No. N-O1P-163 describes new system of combustion control, known as Type P, for smaller industrial or municipal power plant.

40 HEAT EXCHANGER — Niagara Blower Co, 6 E 45th St, New York 17, N. Y. 4-page bulletin No. 96 presents Niagara Aero heat exchangers with new balanced wet-bulb temperature control.

41 INSULATION TESTER—Herman H Sticht Co, 27 Park Pl, New York 7, N. Y. 8-page bulletin No. 445 describes Model C-2 megohmer, which has a new spillproof lightweight storage battery as a power supply for 500-v dc test potential used in making insulation-resistance measurements.

42 AREA FLOWMETER — Fischer & Porter Co, 960 County Line Rd, Hatboro, Pa. 32-page catalog No. 10B, entitled "A New Era in Flow Rate Measurement," discusses the F&P rotameter for measuring flow rate of liquids and gases.

43 PROTECTIVE PAINT — Wilbur & Williams Co, Park Sq Bldg, Boston 16, Mass. First issue of new publication, entitled "The Protectioneer," contains case histories of difficult maintenance painting problems which have been solved by protective materials developed for solution of such problems.

44 DIESEL ENGINES—Joshua Hendy Iron Works, Sunnyvale, Calif. 12-page catalog describes new Hendy Series 50 stationary and marine diesels. Booklet contains specifications and power curves at speeds ranging from 400 to 600 rpm. Chart shows general dimensions.

45 TURBINE LUBRICATION—Texas Co, 135 E 42nd St, New York 17, N. Y. The May, 1944, number of the magazine "Lubrication" contains a 16-page scientific discussion of steam turbine lubricating oils, including lubricating systems and oil tests.

46 TURBINE PUMPS — Worthington Pump & Machinery Corp, Harrison, N. J. 12-page bulletin No. W-324-B2 features Worthington Types TF, TG and TH regenerative turbine pumps for direct-motor steam-turbine gasoline-engine flat- or multi-V-belt drives.

What do You Say, Doc?

THE "DOCTOR"— McGarvey Eddleman of Allis-Chalmers Norwood Works—is taking a temperature reading during the heat-run test. It's just one precaution that helps Allis-Chalmers build consistently great motors.

NO—THAT'S NOT a sick motor. Actually it's a very *healthy* one. But that's something we must know — through generous sample testing — before Allis-Chalmers motors can tackle jobs for you.

Part of the "physical exam" that motor at the left must pass is the heat run test. Bristling with thermometers, the motor runs at full load — and speed and temperature are recorded for every hour.

Five or six hours can tell you a lot about a motor's characteristics —but it takes more like five or six *years* to tell you its *character.*

And it's the test of time in which Allis-Chalmers motors have established that they are *great* motors. That's why you hear so many engineers say: "You can depend on Allis-Chalmers Motors!"

• • •

If you could meet and talk with the men who build Allis-Chalmers motors, you might be surprised to learn how keenly they are aware of the big *personal* stake they have in every motor they build for you.

They know that factory tests to fully pre-determine how well a motor is built *just don't exist;* that there's still no substitute for responsible craftsmanship.

And they know that when they build great motors for you they're making *friends*—and that no company and its workers can have too many of them. ALLIS-CHALMERS, MILWAUKEE 1, WIS. A 1726

♪ Tune in the Boston Symphony, Blue Network, Saturday at 8:30 pm, EWT.

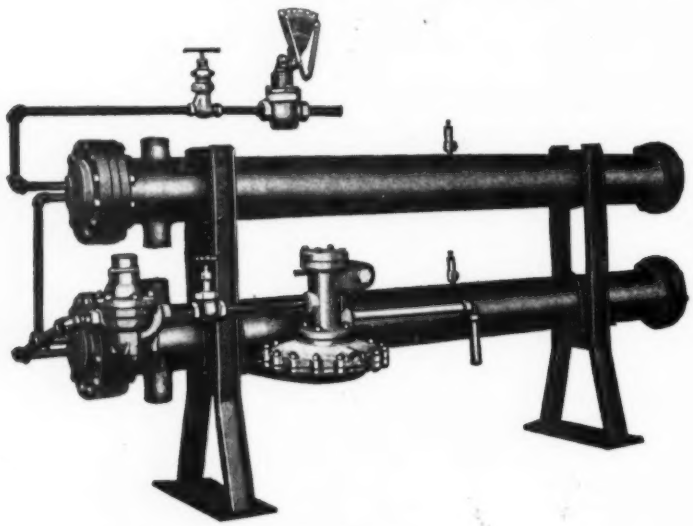
YOU CAN DEPEND ON ALLIS-CHALMERS MOTORS

HENSZEY
CONTINUOUS BLOWDOWN

helps keep BOILERS and other EQUIPMENT on the Job!

The Henszey system continuously and automatically keeps boiler water concentration below safe levels—and without heat loss! *Plan now for your postwar needs of clean, low-cost steam.* We will gladly make an analysis of your boiler water problems to show you what savings can be made by installation of a tailor-made Henszey Continuous Blowdown System.

HENSZEY CO., Dept. D7, Watertown, Wis.



Check these ADVANTAGES . . .

- Produces clean steam—no carry-over.
- Saves up to 95% of the heat loss of ordinary intermittent blowdown.
- Prevents Priming and Foaming.
- Prevents Scale (With simple chemical treatment).
- Automatically controls Boiler Water Concentration.
- Indicates and Meters Blowdown.
- Practical for any size plant—large or small.

HENSZEY

CONTINUOUS BLOWDOWN

Flow Indicators • Distillation Systems • Heat Exchangers
Feed Water Meters • Boiler Feed Regulators • Proportioning Valves

47 **ROTARY PUMPS** — Roots-Connersville Blower Corp, Connersville, Ind. 4-page bulletin No. 61-B11 on cycloidal rotary pumps shows various driving arrangements, including direct-coupled electric motors, gasoline and steam engines, in addition to standard arrangements, such as flat belt or V-belt, gear reducers, etc.

48 **WATER ANALYSES**—W H & L D Betz, Gillingham and Worth St, Philadelphia 24, Pa. 44-page booklet presents various apparatus and chemicals for industrial water analyses.

49 **FRAME CONSTRUCTION** — Unistrut Corp, Wayne, Mich. 20-page general bulletin No. 1 features the Attwood system of frame construction. Booklet describes Unistrut, a single all-purpose structural framing member, for building frame for supporting or holding pipes, conduits, etc.

50 **INDUSTRIAL LUBRICATION**—Sun Oil Co, 1608 Walnut St, Philadelphia 3, Pa. A complete campaign, including posters, wall charts, basic do's and don'ts, specialized lubrication folders, technical bulletins and periodic maintenance memos, designed to "Save and Serve" by proper lubrication, has been prepared by company.

Power News

(*Continued from page* 164)

Pressure for Congressional authorization of the **St. Lawrence waterway** and power project was augmented measurably by State Secy Cordell Hull, who said the project would be an "important contribution" to the nation but its proponents faced two hurdles in enacting the Aiken bill which would authorize the program. Hearings, introduced last fall by Sen George D. Aiken, Vt. Republican, are before a subcommittee of the Senate Commerce Comm.

COAL MISCELLANY

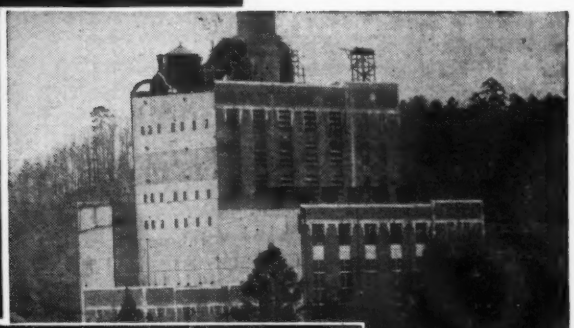
Fuel-conservation manual of the Fuel-Conservation Council for War is available upon request. Cooperative effort of manufacturers of automatic controls, members of the Council, indicates purpose and application of various types of controls in relation to the big national-fuel-conservation job just ahead. Educational, practical and non-promotional, it is valuable for anyone connected with the heating or maintenance of buildings other than family homes.

Consistent with the controls industry slogan, "Fuel conservation *starts* with control," the book specifically indicates *how* controls are a dominant factor in fuel economy. For a copy, write to Fuel Conservation Council for War, 500 W Oklahoma Ave, Milwaukee 7, Wis., or to any of 26 control manufacturers.

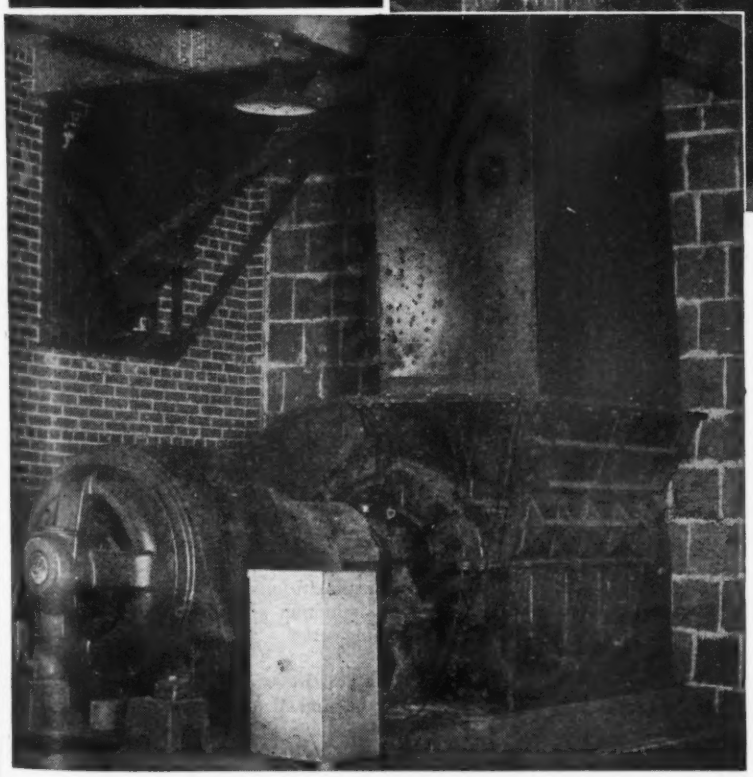
Bituminous coal stocks hit their lowest level, since war started, on Apr 1, when 51,838,000 tons were on hand—a decline of 25,454,000 tons from the total of the corresponding date of 1943, and 39,000,000 tons below the all-time high of Dec, 1942.

In contrast, electric utilities stocks on Apr 1 were 10% above those on Mar 1. The industry had 13,996,000 tons on Apr 1 and Mar consumption, at 6,537,000 tons, was down 2.3% from Feb. Average daily consumption for electric energy during Mar

ALL GRADES OF COAL SATISFACTORILY SIZED WITH AMERICAN RING CRUSHERS



One of the two AMERICAN RING CRUSHERS at the Gorgas Steam Plant of the Alabama Power Company. The first installation (200 tons per hour capacity) was made in 1929—the second, in 1943.

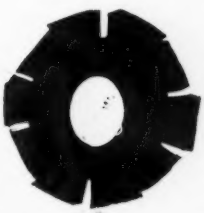


It is generally conceded that power plants will have to depend for steam generation on poorer, lower grade coals—that such coals will be the only ones generally available in the future. Proper preparation of these coals, in spite of difficult grindability, will of course be necessary for combustion efficiency and economical performance.

In the AMERICAN RING CRUSHER lies the solution to the problems of coal availability and grindability, because with the "AMERICAN WAY," any run of mine coal can be reduced to any desired degree of fineness—for stoker use or pulverized fuel firing—in one operation.

The cost of crushing is remarkably low. Actual experience shows that with AMERICAN RING CRUSHERS the total cost including maintenance power, labor, interest and depreciation is less than 1¢ per ton. Many of the nation's leading power plants are already insured against trouble in grinding available coals by having installed "AMERICANS." You have the same opportunity. It will pay you to investigate.

How the "AMERICAN" prepares coal



An important and exclusive patented feature of the "AMERICAN" ROLLING RING CRUSHER is offered in these manganese steel SHREDDER RINGS. These rings give a splitting action which shatters and distributes the coal before it reaches breaker and grinding plates. In contact with tramp metal, rings are deflected in such a way as to avoid injury to crusher. No shear pins or other devices are necessary to insure safety.

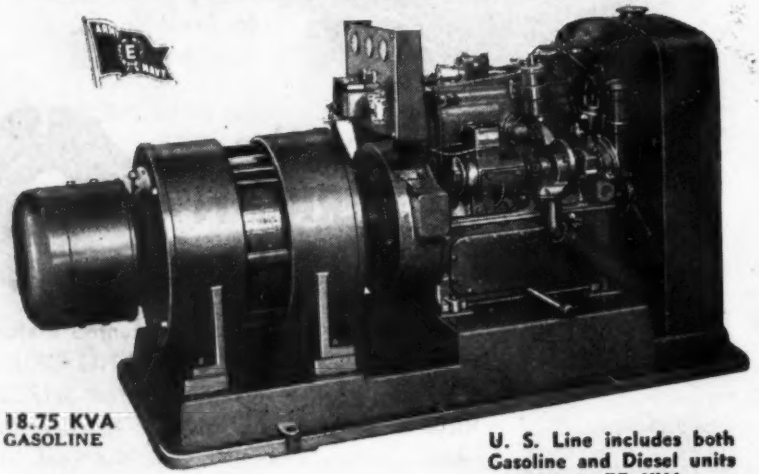
AMERICAN PULVERIZER COMPANY
1219 Macklind Avenue
St. Louis, 10, Missouri
ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS

SUPPOSE
YOUR SOURCE OF
ELECTRICITY

FAILED
THIS MINUTE
?

Would an automatic emergency unit take over? Or would you just suffer your losses? The safest and best insurance against any such losses is a U: S. Stand-By unit. One failure might easily pay for the entire installation. Available now on AA3 priority or better. Write.

UNITED STATES MOTORS CORP.
552 NEBRASKA STREET • OSHKOSH, WIS.



18.75 KVA
GASOLINE

U. S. Line includes both Gasoline and Diesel units up to 75 KW.

U.S. Electric Plants
FOR STAND-BY SERVICE

was 210,871 tons, an 8.6% decrease from daily average Feb use.

Average number of days' supply on hand Apr 1 for electrical energy generation were: New England, 69 days, up 1 day; Middle Atlantic, 59 days, up 7; Ohio, 54 days, up 3; Mich., 73 days, down 9; Ill.-Ind., 61 days, up 2; Lower Mo. Valley, 67 days, up 5; Lake Docks Territory, 86 days, down 5; Southeast, 95 days, up 30; Southwest, Mountain and Pacific, 89 days, up 18. Total, all regions, 66 days, up 6.

If present coal production trends continue, 1944 output will be no greater and possibly less than in 1943, says *Coal Age*. To close any gap that may exist to prevent coupon rationing of solid fuels, to avoid the heatless days of World War I and to prevent an unjustified black eye for the coal industry, the article suggests:

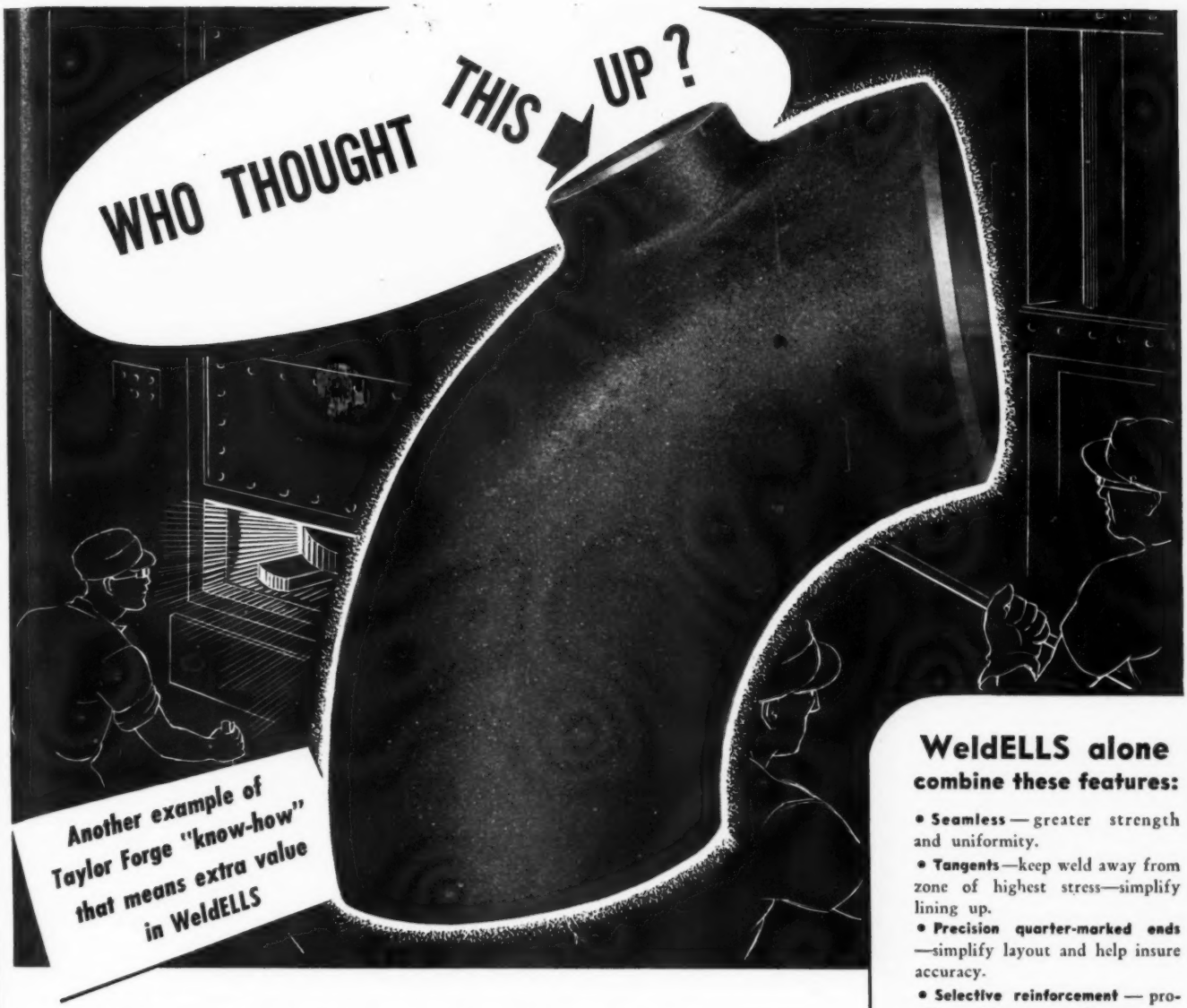
(1) Maintaining or increasing production by every possible use of more efficient methods and equipment, reduction of absenteeism, tapping every possible source of manpower, increased pressure on selling management and men on their part in the war. (2) Promoting conservation in use by adopting for the period of the emergency a new outlook on sales, organizing to promote efficiency in coal use, and selling conservation to the hilt.

George A Lamb, formerly chief, economics and statistics div, Solid Fuels Adm for War, has a newly created post: asst director, **Bureau of Mines.** Virtually all activities of his former division have been transferred to the Bureau of Mines. Mr. Lamb will direct coordinating programs of the Bureau and will administer the expanded activities of the Economics and Statistics Service, which maintains authoritative information on all mineral commodities.

Bituminous Coal Research, Inc, has elected Dr H J Rose, Mellon Institute, Pittsburgh, vice-president and director of research, in charge of the expanded investigational and developmental program of the bituminous coal industry. This organization of coal operators, associations and railroads in the Appalachian and Mid-Continent coal fields is enlarging its research projects on coal production and utilization to meet wartime problems and to prepare for and strengthen the industry's postwar position. More than $2,000,000 will be invested in research in the next 5 years.

Gasoline-injection system for supplying liquid fuel to gasoline-engine cylinders has been perfected and is now in operation, American Bosch Corp announced. Higher efficiency, even with lower-grade gasolines, greater responsiveness, smoother power delivery and elimination of the fire hazard of an explosive mixture of gasoline and air in the induction system are some of the advantages.

The Southwest will have great opportunity for expanded prosperity if it utilizes its fuel resources, E R Kaiser, fuels technologist, Battelle Institute, told the first Southwest Chemurgic Clinic. Coal reserves of Ariz., Colo., Kans., Mo., New Mexico, Okla. and Tex. amount to over 538 billion tons of minable coal. Only two-tenths of 1% of the original reserves have been mined.



YOU would almost think the pipe designer had gone out of his way to figure out this one—a special, seamless, seven-inch carbon-moly WeldELL with an integrally formed 3-inch outlet. But of course this special fitting was needed, and actually it isn't as special as many other problems which are put up to us by engineers who have found that we have a way of licking them.

For every "special" that is required a thousand standard fittings are needed, of course. But it is the "know-how" acquired through years of solving problems like this that enables us to provide so many "special" features in WeldELLS—features that mean added value and better engineering.

One good example of this is the uniform strength engineered into WeldELLS through proper distribution of extra metal where stresses are higher. Another is the extreme dimensional accuracy which results from special truing operations. Tangents, too, require a special process which is justified only because it results in a better fitting.

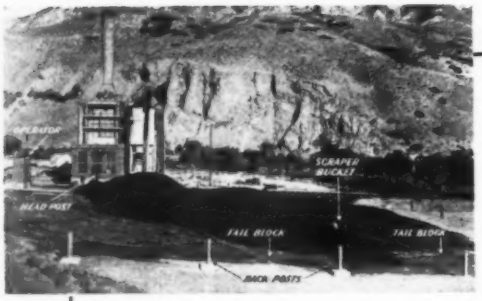
In fact, if you will check the list of features opposite, we believe you will agree that only the specialized "know-how" and facilities of Taylor Forge could give you these fittings that . . . *"have everything!"*

WeldELLS alone combine these features:

- **Seamless** — greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility

WeldELLS have everything

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.



a one-man SYSTEM for Storing Coal

Above is pictured a small Sauerman scraper system arranged for hand shifting of tail-blocks. Picture was taken soon after machine was installed and accordingly shows only the start of the storage pile which eventually covered the entire storage area to a height of 16 ft. Installations similar to this, powered with 20 hp. to 60 hp. motors are giving satisfaction at many power plants.

An even more efficient type of installation is the Sauerman scraper machine with self-propelled tail tower traveling on a track along the perimeter of the storage area. Most of the larger Sauerman installations today are of this type and it is recommended for small projects too as a means of assuring layer piling without extra labor. A Sauerman system with mobile tail tower stacks one thin layer of coal on top of another and thus builds a homogeneous pile 30 ft. or more in height that is safe against any danger of heating.

AT hundreds of power plants, large and small, SAUERMAN Power Drag Scrapers are storing and reclaiming coal at costs of only a few cents per ton.

A Sauerman System is simple and easy to operate. From a station overlooking the storage area the operator controls every move of the scraper through a set of automatic controls.

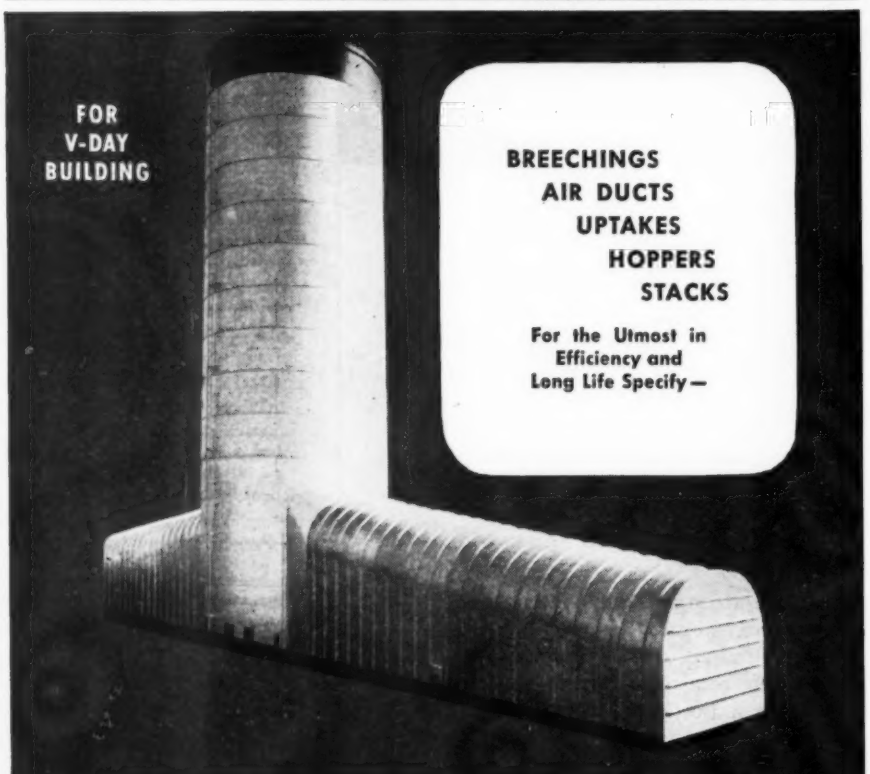
A Sauerman Scraper stocks the coal in compact layers. There is no segregation of lumps and fines—no air pockets to promote spontaneous combustion.

Each Sauerman installation is a permanent, trouble-free investment—maintained at small expense.

Write for Catalog

SAUERMAN BROS., INC.

562 S. CLINTON ST. CHICAGO 7, ILL.



CONNERY CONSTRUCTION CO.

SECOND & LUZERNE STS. PHILADELPHIA

These tremendous reserves assure low-cost coal and metallurgical coke for the Southwest far into the future.

Kaiser advocated that the Southwest promote the utilization of their coal reserves for industrial heating and power purposes and earmark as far as practical their petroleum and natural gas reserves for the gasoline trade. Coal from these resources, for the most part, is not a commodity for outside markets, while the Southwest's petroleum and gas will be prized in postwar trade. By burning petroleum and gas where coal could suffice, the Southwest is burning future prosperity.

Known reserves of natural gas and petroleum will not last a generation at the present rate of consumption. Studies might well be undertaken to determine whether the Southwest should utilize its coal reserves for generating steam and electric power, for driving locomotives, and for home and industrial heating. By using coal for such purposes, oil and gas can be conserved for other use, such as production of motor fuel, for which there is no economical substitute.

Natural gas is a strategic material because it can be converted into gasoline more readily than any raw material other than petroleum. Cost of converting natural gas to gasoline is but about one third the cost of converting coal to gasoline, according to Kaiser.

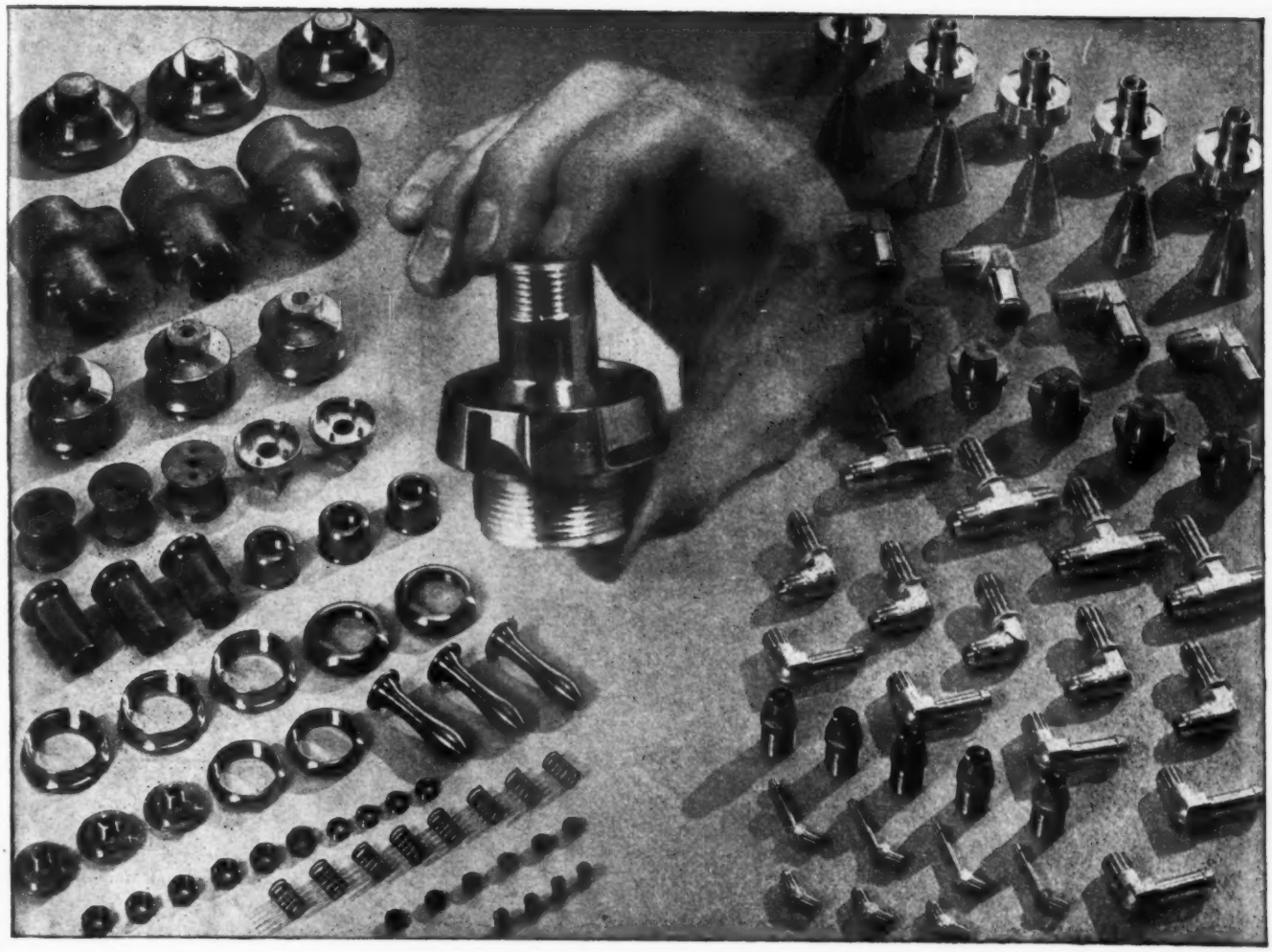
Coal stockpiling program, to insure that no mines are idle this summer, is shaping up as follows: Defense Supplies Corp will buy coal from mines that have no orders and stockpile it for next winter. DSC is merely to place standing orders with producers who believe they may shut down for want of orders—a situation that has lost some production in midwestern fields.

The program in no way competes with commercial, industrial or residential fuel buyers, the aim being to keep government stockpiling to a minimum while insuring full production. Deputy Solid Fuels Adm Potter warned that the program will not be a substitute for assiduous stockpiling by buyers. As now contemplated, it would cover only slow-moving coals from Ia., Ill. and western Ky., but it is broad enough to cover all midwestern and Rocky Mt coal.

Boiler Manufacturers Discuss Wartime Problems

Only a day before the Allied armies invaded the shores of France, the American Boiler Mfrs Assn and Affiliated Industries had gathered at Skytop Lodge, Skytop, Pa., to discuss many wartime problems faced by the executives of companies making boilers, firing equipment and other equipment associated with steam generation. Running June 4 to 7, it was the 56th annual meeting of ABMA & AI. A C Weigel, newly elected president of the association, is vice-president, Combustion Engrg Co; F C Brinig, president, Erie City Iron Works, became the new vice-president; A C Baker, of Cleveland, Ohio, was reelected secretary-treasurer.

In the associate members group, Philip W Swain, Editor of POWER, was reelected



WAR *is a great teacher...*

The Sloan Valve Company has been working around the clock in the War effort since Pearl Harbor. Not only do we now make a Sloan VICTORY Model Flush Valve, which has conserved thousands of tons of copper, but we are producing millions of parts for airplanes, tanks, armored vehicles, anti-aircraft fire control, etc., in addition to vast quantities of ammunition fuzes of various kinds.

Because of this War work, which involves machining to micro-tolerances on a mass production basis, the Sloan Flush Valve of tomorrow will be better than ever before. Already we have a new and improved Flush Valve completely tested and approved ready for peacetime announcement and production.

Sloan Flush Valves have been precision-made water measuring instruments for over a third of a century. Their success is bespoken by the fact that there are more Sloan Flush Valves sold than all other makes combined.

SLOAN VALVE COMPANY

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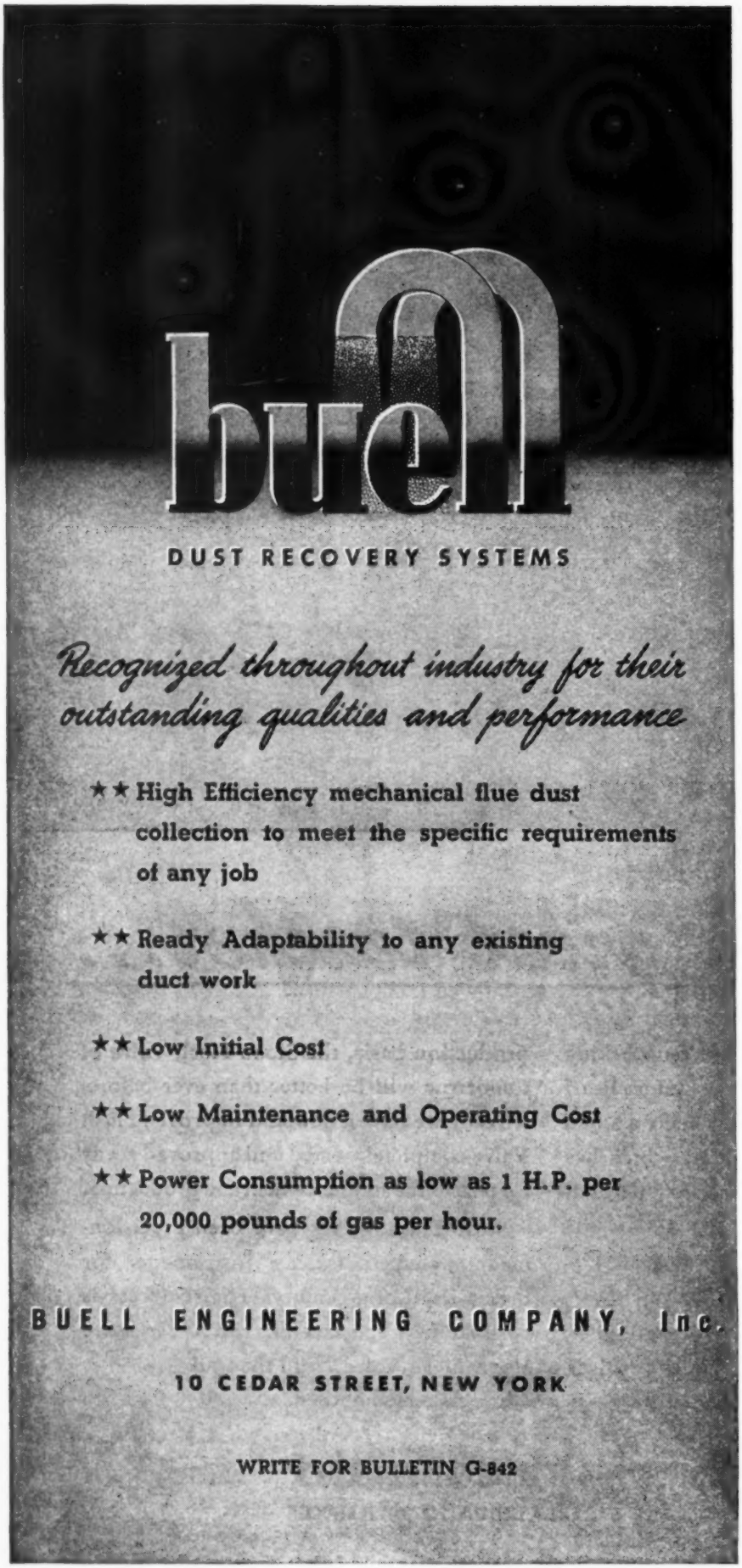
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DUST RECOVERY SYSTEMS
Recognized throughout industry for their outstanding qualities and performance
★★ High Efficiency mechanical flue dust collection to meet the specific requirements of any job
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★★ Low Initial Cost
★★ Low Maintenance and Operating Cost
★★ Power Consumption as low as 1 H.P. per 20,000 pounds of gas per hour.
BUELL ENGINEERING COMPANY, Inc.
10 CEDAR STREET, NEW YORK
WRITE FOR BULLETIN G-842

Buy War Bonds and Make the Axis Bite the Dust

Chairman, and W P Thomas, Diamond Power Specialty Co, became Vice Chairman.

Because steam generation plays such a vital part in war production and in all industrial postwar plans, four key men from Washington, including three from the government, were speakers.

Official war agencies were represented by Edward Falck, successor to J A Krug, as director, Office of War Utilities, War Production Board; by Frank E Hutton, WPB, and by Alex Taub, chief engineer, Foreign Economic Administration. S T Henry, assistant to the president, McGraw-Hill Publishing Co, was the fourth featured speaker.

Smoke Prevention Assn of America, Inc, will hold its 38th annual meeting in Detroit, Mich., June 6–9, Hotel Statler. Speaking are: R R Sayers, director, U. S. Bureau of Mines, on "Fuel Conservation Program"; J E Tobey, "Influence on Postwar Smoke Abatement Work of Bituminous Coal Research Program"; H P Dolan, "Service Training of the Operating Personnel as It Affects Fuel Conservation and Smoke Abatement. Others on the program are: T W Rea, "New Developments of Front Overfeed Stokers"; J A Hoffman, Fly Ash Collection at the Boiler"; O de Lorenzi, "Studies of Stoker Fuel Beds."

OBITUARIES

Vernon Edler, vice-pres and general mgr, Peerless Pump Div, Food Machinery Corp, died May 1 at the age of 47.

Michael M Klosson, chief engr, Buffalo Pumps, Inc, died Apr 11 at the age of 51.

E D Dickinson, 66, who when he retired last May was designing engr, turbine engrg div, General Elec Co's Lynn River works, died on April 28.

Thos E Delaney, member, North Jersey chapter, Power Transmission Council and sales representative, Middle Atlantic area for Holyoke (Mass.) Belting Co., died on May 6.

Harry W Hough, 59, vice-pres in charge of operations, Cleveland Electric Illuminating Co, died May 8 after a brief illness.

C H M Jones, 58, asst to pres, Todd Shipyards Corp, died unexpectedly on May 25.

N E Drexler, former pres, Tidewater Power Co., died on May 17 in Wilmington, N. C.

L C Bradley, 69, former pres, Virginia Elec & Power Co, died May 13 after a brief illness.

Clifford Notzel, secy-treas, Pumps & Power Ltd, Vancouver, died recently.

H R Peckham, 56, vice-pres in charge of operations, San Diego Gas & Elec Co, died recently.

H W Moses, 60, retired head, industrial relations dept, Boston Edison Co, died May 14.

We'll let you be the JUDGE . . .

ROSS

HEAT EXCHANGERS
COOLERS
HEATERS
CONDENSERS

Take any heat exchange problem. Take any shell and tube heat exchange equipment—heaters, coolers, condensers—for land or sea.

Then compare Ross' facts and figures on design, construction, performance and maintenance.

We'll let *you* be the judge of features that have influenced over 81% of Diesel engine manufacturers alone to specify "Ross" coolers as original equipment.

Write for any or all of these informative Ross catalogs, and weigh the qualities for yourself.

Surface Condenser	Standard Coolers	Oil Heaters
Manual No. 4017	Manual No. 5322	Bulletin No. 3624-A

ROSS HEATER & MFG. CO., INC.

Division of AMERICAN RADIATOR & Standard Sanitary CORPORATION

GENERAL OFFICES AND PLANT: 1415 WEST AVENUE, BUFFALO 13, NEW YORK

Small . . . but MIGHTY!

. . . the MIDGET "MEGGER"* TESTER is ALWAYS READY FOR USE . . . ANYWHERE

Weighing but 3 pounds, this mighty midget can be carried in a coat pocket or tool kit . . . instantly available for testing insulation resistance of practically all types of electrical equipment . . . indispensable for maintenance and trouble shooting, even where the higher range "Megger" sets could be used. Reads up to 50 megohms and delivers 500 volts D.C. from a built-in hand-cranked generator, making it independent of batteries or external power supply.

If you are not already familiar with this smallest and in many ways the most remarkable instrument bearing the "Megger" trademark, write for Bulletin 1545-P.

Ask also for Bulletin 1535-P describing the new U. S.-made "Megger" Testers.

**Trade Mark Reg. U.S. Pat. Off.*

JAMES G. BIDDLE CO.

1211-13 ARCH STREET • PHILADELPHIA 7, PA.

Appointments

General Electric Co announces these appointments: **H S Hubbard,** asst engineer, power transformer engrg div at Pittsfield, succeeding A B Hendricks, Jr, retired after 43 yr service; **Chas J Koch,** engineer, and **Frank D Phillips,** asst engineer, induction motor engrg div, succeeding H M Maxwell and M H Wells; **Harold E Strang** to the staff of H A Winne, vice-pres, in charge of design engrg, apparatus dept; **H V Erben,** newly elected commercial vice-pres.

Westinghouse Elec & Mfg Co have made these appointments: **Quincy M Crater,** asst mgr, Detroit office territory; **Frank H Butt,** supervisor, switchgear and control order service; newly elected vice-presidents are **R A Neal, J K B Hare, John H Ashbaugh** and **H H Rogge.** Westinghouse Electric Internatl Co elects **John W White** pres and genl mgr; **Wm E Knox,** vice-pres.

Allis-Chalmers names **John Avery** manager, blower and compresser dept, to succeed G L Kollberg, who is retiring . . . **Monsanto Chemical Co** appoints **Felix N Williams** genl mgr, plastics div, and **C G Gress** sales mgr, plastics div's resinox dept. **Carl Whitlock** is mgr of plastics materials sales in Detroit . . . **U. S. Rubber Co** makes **Alexander S Basil** asst mgr of the Lowell, Mass., plant, and **I L Cantwell** sales mgr of battery separators . . . **W W Scull** has been appointed mgr of the synthetic rubber plant operated at Port Neches, Tex., by **The B F Goodrich Co** for the government.

Caterpillar Tractor Co names the **Cliff Miller Machinery Co** distributor for the Omaha, Neb., territory . . . **Minneapolis-Honeywell Regulator Co** makes **Kentner L Wilson** mgr of the Detroit, Mich., office, and **D J Peterson** mgr, heating-control div of the Cleveland zone . . . **Brown Instrument Co** elects **Paul L Goldstrohm** and **Geo M Muschamp** to the board of directors; it places **A J McCullough** and **J E MacConville** in joint charge of industrial instrument sales . . . **Dresser Mfg Co** has elected **J B O'Connor** executive vice-pres, and **A R Weis** and **L C Harvey** vice-pres . . . **Yeomans Bros Co** makes **Thompson Pipe and Steel Co** its Denver representative . . . **U. S. Machine Corp** has appointed **Electrol Oil Burner Corp** distributor for territory in Oregon and Washington and for British Columbia and Alaska.

Carrier Corp has added **Dr. Wm A Pennington** to the research staff of its engrg div; it names **Wm A Haile** mgr, international div's Washington office; and **Colin McCullock** market research mgr in Syracuse. **C M Stuart,** staff asst to the pres, has a leave of absence to become deputy chief, special equipment branch, genl industrial equipment div, office of operations, WPB.

O F Achtenhagen has bought the Radio and Appliance Distributing Co of Denver, Colo., a long-established **Philco Corp** distributor . . . **Barber-Colman Co** announces that **D J Stewart** is vice-pres and genl mgr and that **H F Collins** is works mgr . . .

❶ Core is made of high grade electrical sheet steel laminations insulated to insure minimum core loss.

❷ Coils are form wound, and thoroughly insulated before being placed in the slots. Coils are securely held in slots by fibre wedges and the ends securely braced to prevent movement.

❸ Frame constructed of welded steel with heavy cross ribs to rigidly support core laminations. Stator is well ventilated, the solid coil shields directing flow of air over coils and exhausted in frame openings.

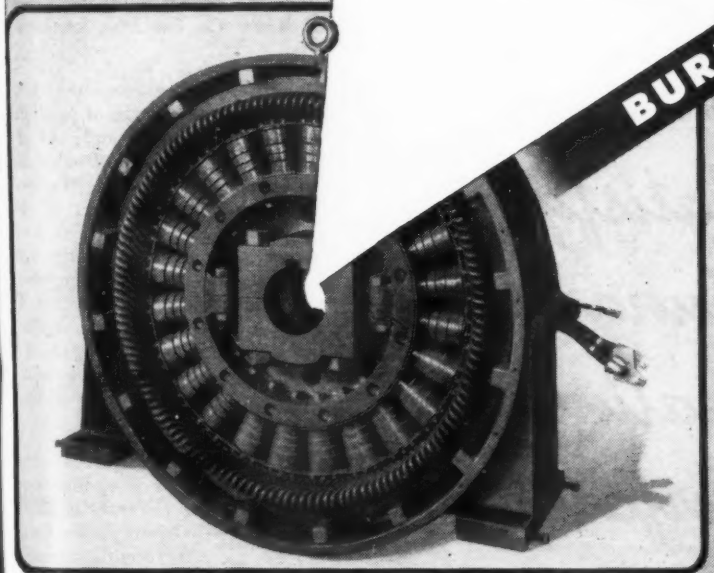
❹ Field Coils form wound, thoroughly dipped and baked. Coils are well insulated from poles, and fitted fibre washers hold them permanently tight.

❺ Each Pole Assembly is securely fastened to the Rotor by 2 large studs thru rim and anchored in large rectangular steel rivet insert which serves to hold laminations firmly together.

❻ Rotors are of heavy all steel construction. Rotor made with solid hub, split hub, or can be completely split.

❼ Starting winding embedded in pole face and brazed to end rings which are riveted between poles.

❽ Collector Rings are of bronze with good wearing and conductive properties.



BURKE BUILT IS WELL BUILT

BURKE

SYNCHRONOUS MOTORS AND GENERATORS

TYPICAL of the construction of the larger Burke Synchronous Motors and Generators is that detailed here. Burke as one of the oldest builders of Synchronous equipment, has stressed quality in every detail for over fifty-four years. These motors are built to meet your specifications and are available in all sizes from 1 to 1500 h. p. in belted, direct or engine types either sleeve or ball bearing equipped and with Exciter on top or direct connected. Burke engineers are ready to meet your war demands or to help you prepare for the post war period.

Write today for specific data.

BURKE ELECTRIC COMPANY • ERIE, PA.

SYNCHRONOUS MOTORS AND GENERATORS | INDUCTION MOTORS | D. C. MOTORS | D. C. GENERATORS | M. G. SETS | HIGH SPEED A. C. GENERATORS

MOTORS 1 TO 1500 H. P. • GENERATORS 1 TO 1000 K. W.

BURKE A.C. & D.C. Motors & Generators

BURKE ELECTRIC COMPANY, ERIE, PENNSYLVANIA • *Since 1891*

COAL SAVING

A Natural Result of Using the

FREDERICK INDUSTRIAL STOKER

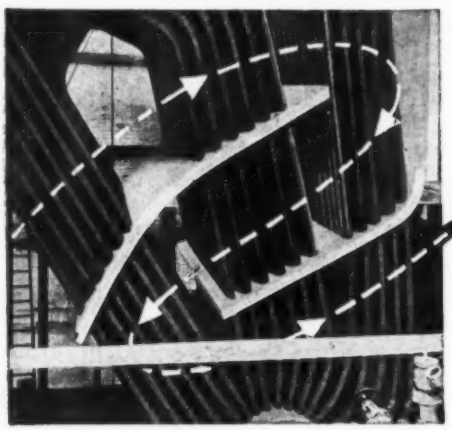
You are perfectly safe in installing a FREDERICK INDUSTRIAL STOKER with the expectation of a reduction in coal bills. The FREDERICK was specifically designed to meet the heavy-duty requirements of industrial installation. Its matchless design was perfected to assure high rating with low combustion rate per square foot of grate area. Underfeed firing gives maximum extraction of heat from every pound of coal consumed. There's saving in transportation cost as well.

Learn all about FREDERICK INDUSTRIAL STOKERS. The knowledge points the way to Coal Saving through complete stoker efficiency.

FREDERICK STOKER BULLETIN Sent Promptly On Request.

THE *Frederick* IRON & STEEL CO.
Frederick, Maryland

ENCO BAFFLES



Satisfy Hungry Heating Surfaces

...and many boiler heating-surfaces are literally and unnecessarily starved. They need Enco Baffles to increase heat absorption, to boost efficiency and to increase steam output. Enco Baffles revitalize boilers by providing streamlined cross-flow of gases over the tubes, and by eliminating eddy currents, bottlenecks and dead gas pockets. Bulletin BW40 gives further details. It is yours on request.

THE ENGINEER COMPANY
75 WEST STREET Enco NEW YORK, N.Y.

Raybestos-Manhattan, Inc has elected **Harry E Smith** and **Robt B Davis** vice-pres . . . **Harnischfeger Corp** has appointed **Frank M Blum** mgr, P&H crane sales div . . . **Delmar DeWolf** is the new adv mgr of **Skilsaw, Inc** . . . **John D Beebe** is mgr of the new rubber suspension sales dept, **The B F Goodrich Co.**

Clifford H Wyman is now sales mgr, **Dugas Engrg Corp.** The co's new quarters in New York are at 60 East 42nd St . . . **Jas F Reid,** former deputy chief, alloy steel branch, WPB is production mgr, **The Timken Roller Bearing Co** . . . **Joshua Hendy Iron Works** appoints **Clarence F Jensky** representative on turbine design, construction and mfg in Washington, D. C. . . . **Hanlon-Waters** has been acquired by interests owning McAlear Mfg Co and **Climax Engrg Co** and will operate as a div of the latter group . . . **Douglas S Seelye** is appointed chief engineer, **The Terry Steam Turbine Co,** succeeding R O Muller who is retiring because of ill health.

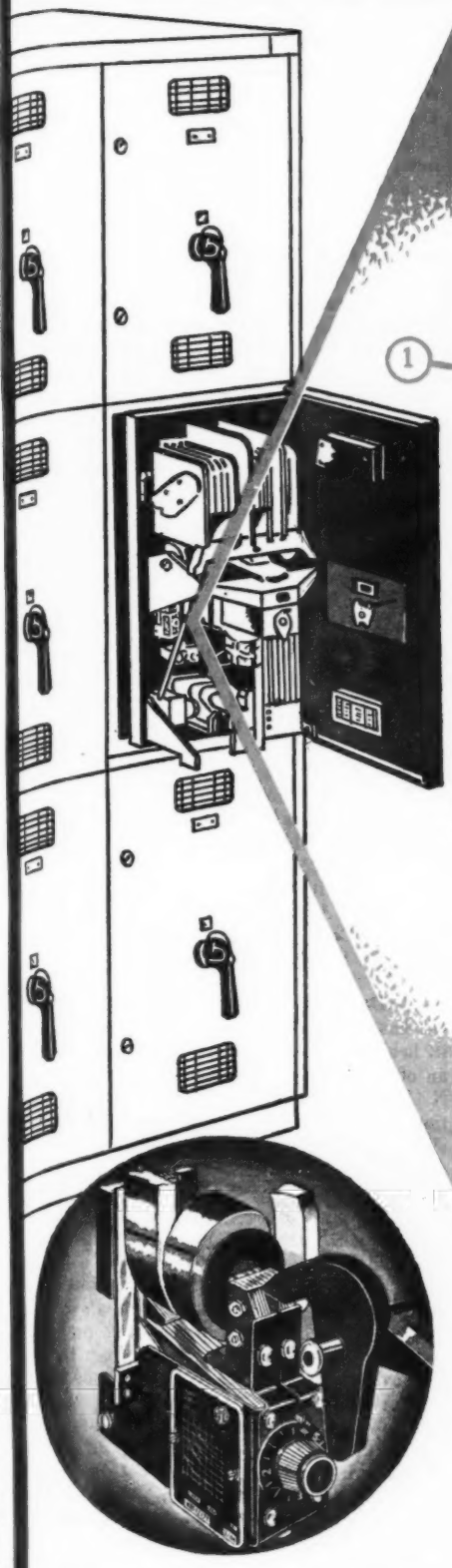
Link-Belt Co appoints **F H Herndon** mgr, coal stoker div, and **K C Ellsworth** sales mgr, stoker div; sales office and warehouse has been opened in Spokane, Wn., **H A Garland** in charge . . . **Air-Maze Corp** appoints **E H Mintie** direct factory representative and field engineer of Calif. and Ariz. . . . **Albert P. Leonard** is manager, N. Y. office, **Farrel-Birmingham Co** . . . **H G Mueller and Associates** announce a new engrg service to manufacturers for product engrg, with offices in Erie, Pa . . . **Yale & Towne Mfg Co** announce that the purchase of the scale business of **Kron Co** has been consummated.

Sullivan Machinery Co announce that **J A Drain, Jr,** is vice-pres in charge of product engrg, research and development; **O J Neslage** is vice-pres in charge of sales in U. S. and Mexico . . . **Boston Woven Hose and Rubber Co** appoints **H F Maxon** genl sales mgr; **W I Lewis,** asst genl sales mgr; **W F Carroll,** district sales mgr in N. Y. and Pa . . . **Enterprise Engine & Foundry Co** announce that **J Neil Brophy** will represent the engine div, covering New England from the N. Y. office . . . **Geo R Conover** is vice-pres in charge of personnel and public relations, **Philadelphia Electric Co.**

L J Wing Mfg Co announces these sales representatives: **Wm H Neville,** Birmingham, Ala.; **Johnson & Scott,** Memphis, Tenn.; **Richard Barthelmess Sales Co.,** Jacksonville, Fla . . . A recently created plastics and chemical sales div, **Goodyear Tire & Rubber Co,** will be headed by **Herman R Thies** . . . **American Engrg Co,** stoker div, has appointed **R C Adams** Chicago district mgr . . . **The Austin Co** names **H A Anderson** eastern district mgr, succeeding J K Gannett, who is now director of engrg . . . **The Electric Storage Battery Co** announces that **C F Norberg** is vice-pres in charge of mfg, and **D N Smith,** comptroller.

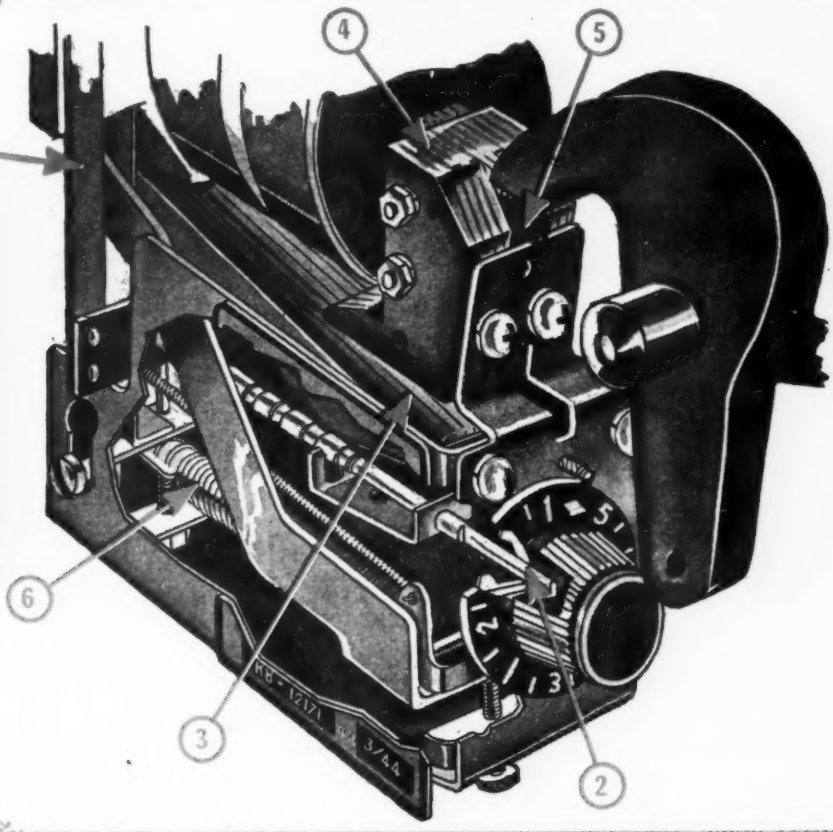
Norton Co appoints **W H Henson** refractories field engineer. **Eugene A Fischer** succeeds him as New England refractories engineer . . . **McCulloch Engrg Corp**

eatures of I-T-E DRAWOUT SWITCHGEAR



Mounted on the side of each Thermomagnetic Overcurrent Trip is a plate showing typical time-load curves corresponding to identified dial settings. The dial is notched to permit intermediate settings, numbering fifteen in all. A spring lock prevents accidental turning of the knob.

A-C Motors get full protection with this Dual Thermomagnetic Overcurrent Trip



(1) **BIMETAL ELEMENT,** heated inductively, causes circuit breaker to open on normal overloads only after a selected time delay. Full voltage starting is permitted with heavy inertia loads yet protection is given against light, continuous overloads such as single phasing. Heating of the element is so arranged as to avoid burnout or permanent distortion. No current flows through the bimetal.

(2) This **SHAFT** is moved forward by the heated bimetal element in starting the action of tripping the circuit breaker. The tripping effect of the forward motion is adjustable at the knob into which the shaft fits. This is like changing the bimetal heating characteristics in relation to the characteristics of the protected motor or in relation to ambient temperature.

(3) This **ARMATURE** moves, in tripping action, either in response to a preselected temperature in the bimetal or to the existence of an overload in the motor circuit equal to twelve times the rated current of the circuit breaker. This gives instantaneous opening on short circuits yet provides time delay for starting peaks and light overloads.

(4) An **ELECTROMAGNET,** energized by a surrounding series coil, has three functions: to attract the armature for direct tripping of the circuit breaker in response to extremely heavy overloads and short circuits; to serve in inductively heating the bimetal element on light overloads and by saturation to control the effect of overcurrents on the heated parts in order to prevent burnout or damage to the bimetal element.

(5) **A TRIPPING PIN** is driven against the latch of the circuit breaker when the armature is attracted to the magnet. Circuit conditions which affect the magnet are directly translated into circuit-opening action when opening is necessary.

(6) This **SPRING,** which carries no current, is preloaded to supply the correct restraint on the armature so that overcurrent of less than 12 times the rated current of the circuit breaker will cause opening only after an exactly appropriate time delay.

In combining the best characteristics of thermal overload devices and magnetic tripping, the I-T-E Thermomagnetic Trip provides protection for individual A-C motors against the effects of both light and heavy overloads. The breaker is tripped before dangerous motor temperatures are reached, but the breaker is not opened needlessly. The time-current characteristics of the device can be adjusted in exact keeping with the heating characteristics of the motor. Motors so protected can be used at full rating. For complete information, call your nearest I-T-E representative or write to I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pa.

Representatives in Principal Cities

I-T-E AIR SWITCHGEAR

Randolph "4" CARBON DIOXIDE FIRE EXTINGUISHER

A startled worker snatches the *nearest* extinguisher. No time *now* to think . . . hit the blaze *before* it does damage!

Randolph "4" *simplifies*—speeds fire fighting. Smothers flammable liquid, electric, machine fires with instant, easy action.

Approved and labeled by Underwriters' Laboratories, Inc.

***Mobilize* against fire with Randolph carbon dioxide. For prompt delivery phone your supply house or write us—today.**

Easy! So obvious and easy . . . any employee can use it. No valves to twist or horns to raise. Just touch the trigger . . . and powerful carbon dioxide smothers the fire in a penetrating, icy blanket!

Safe! Randolph carbon dioxide does not conduct electricity or damage equipment. Dry and odorless . . . it disappears *after* the fire is out. Does a neat job!

Efficient! Carbon dioxide will not deteriorate. It remains effective even in extreme temperatures. Keeps maintenance at a minimum . . . eliminates annual refilling problem.

Randolph "2" Ready to combat sudden "flash" fires. This compact, small unit with exclusive Randolph design, is especially adapted for BUSES, TRUCKS, MARINE CRAFT. Ideal, instant protection for HOTELS, HOSPITALS, INDUSTRIAL KITCHENS.

SEND NOW *for free booklet "Sharpshooting at Flames." Illustrates latest techniques in carbon dioxide fire fighting.* NAME_____

ADDRESS_____

RANDOLPH LABORATORIES *INC.*

8 EAST KINZIE ST., CHICAGO 11, ILLINOIS

appoints **Eugene W Wasielewski** chief engineer . . . **Worthington Pump & Machinery Corp** has appointed **W D Smith** commercial vice-pres . . . **P H Anderson** has charge of the new Indianapolis office of **Revere Copper and Brass, Inc** . . . **W E Bisler** is now an industrial engineer with **Dowell, Inc,** subsidiary of The Dow Chemical Co . . . **Sylvania Electric Products, Inc,** has promoted **H H Rainier** to be asst mgr, distributor sales, radio div.

Union Carbide & Carbon Corp elects **Fred H Haggerson** pres, succeeding Benjamin O'Shea, who is now board chairman . . . **Murray G Day** is New England representative of **Natl Valve & Mfg Co,** with offices in Boston . . . **The Bristol Co** announces that **H C Clarke** is district mgr, Pittsburgh, and that **G H Gaites** is regional sales supervisor of the new Cleveland office . . . General American Process Equipment, **new div of General American Transportation Corp,** has opened a New York office at 420 Lexington Ave. The new div includes Louisville Drying Machinery Co, the Conkey Co, the Turbo-Mixer Corp and the American Machine Co.

Fairbanks, Morse & Co has opened an office in Tulsa, Okla., with **Frank D Ratcliffe,** district mgr, oil industry sales, at 1335 Hunt Bldg . . . **M H Detrick Co** has changed its address to 2338 Oliver Bldg, Pittsburgh 22, Pa . . . **Rome Mfg Co Div,** of Revere Copper and Brass Inc, has opened a sales office in the New York Central Bldg. **Donald G Noakes** is district mgr . . . **Brill Equipment Co** has moved its offices to 225 West 34th St, New York 1, N. Y., and its warehouses and shops to 2401 Third Ave, Bronx, N. Y. . . . **Allen-Bradley Co** has moved its offices to 155 East 44th St, New York 17, N. Y.

N E Drexler, pres, Tide Water Power Co, has tendered his resignation because of ill health . . . **Wm G Christy** has opened an office at 921 Bergen Ave, Jersey City 6, N. J., as consulting engineer on combustion, boiler plants, smoke, dust, cinder abatement . . . **Henry J Gille,** mgr, industrial and agricultural development, Puget Sound Power & Light Co, retired after 54 years in the electrical industry, 31 of which he spent with Puget Power.

Paul F Hatch is acting district engineer, Mid-Columbia district, Bonneville Power Adm, handling engrg and operating problems relating to customer service from the Bonneville-Grand Coulee power system in southeastern Wn.-eastern Ore. area . . . **Jas P McKearin,** chief engineer, **Western Mass. Electric Co,** Springfield, Mass., has retired. He is succeeded by **John W Bennett,** who had been asst chief engineer . . . **Walter P Arnold,** technical director, **Koppers Co,** wood-preserving div, was elected pres of American Wood-Preservers' Assn at its 40th annual meeting.

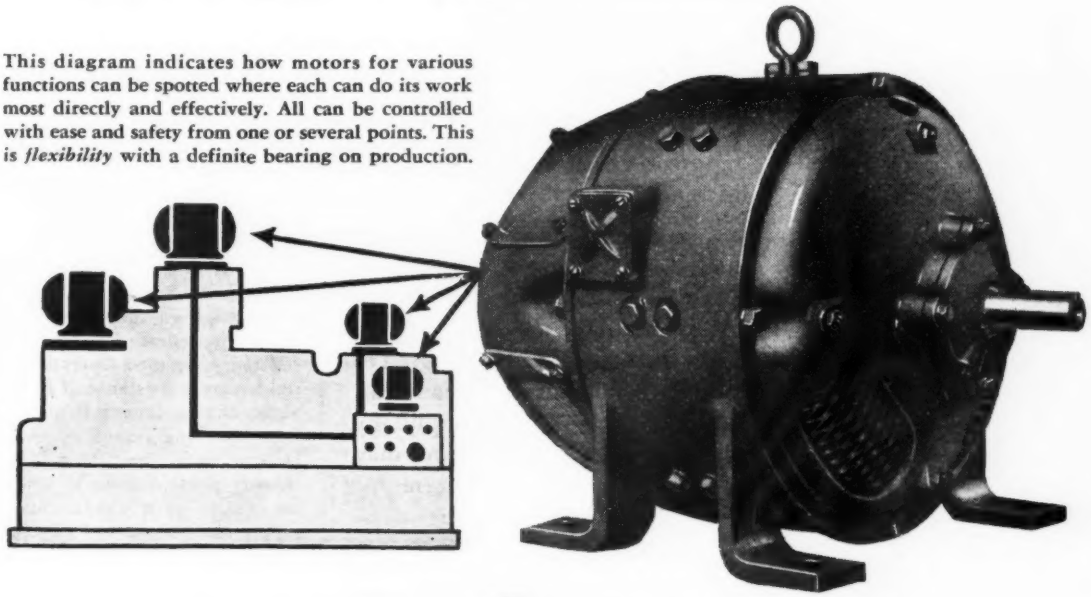
Natl Assn of Fan Mfgrs elected at the 27th annual meeting: C. T. More, pres; J. M. Frank, vice-pres; L. O. Monroe, secy-treas. Members make fans and blowers exclusively for the war program: heating, ventilating, drying, cooling, mechanical draft for boilers in power plants, etc.

FLEXIBILITY

To designers and users of modern production machines Reliance Motor Drive offers flexibility combined with simplicity. Without gears, brakes, clutches or other mechanical go-betweens it performs all these functions: speed control, reversing, controlled acceleration, braking, remote control, slow speeds for inching, threading or inspection.

Reliance application engineers are production minded. They have had wide experience in cooperating with manufacturers' engineers on specific motor-drive applications. We think you will like the way they work. Just phone or write our nearest office.

This diagram indicates how motors for various functions can be spotted where each can do its work most directly and effectively. All can be controlled with ease and safety from one or several points. This is *flexibility* with a definite bearing on production.



RELIANCE A·C D·C MOTORS

RELIANCE ELECTRIC & ENGINEERING CO.

1088 Ivanhoe Road • Cleveland, Ohio

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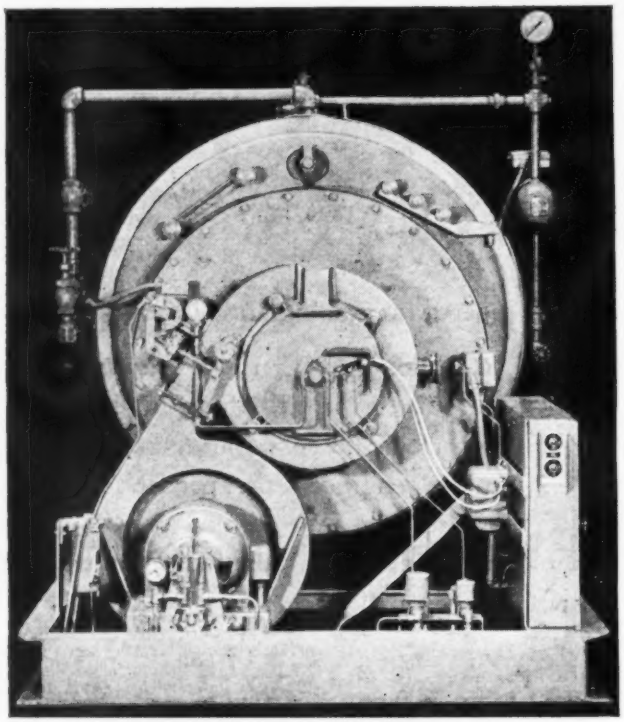
DOLLAR EFFICIENCY—work done per dollar spent—measures the value of steam generation



Ready accessibility to controls and gauges, all of which are mounted on the unit's front, is a feature of the 100-horsepower Cyclotherm Steam Generator shown above.

This unit, like all Cyclotherms, operates on exclusive principles of combustion and design that provide high efficiency at low cost of operation.

Cyclotherms are fully automatic and completely self-contained. They are both oil and gas fired in a power range from 10 to 300 horsepower.

Commercial deliveries are being made as rapidly as the press of Government orders permits. If you are planning immediate replacement, our engineers will be glad to cooperate in meeting your needs. We shall be happy to supply any additional information you may desire concerning Cyclotherm.

CYCLOTHERM
STEAM GENERATOR

AMES IRON WORKS
OSWEGO . . NEW YORK . . BOX 502

New Equipment

(*Continued from page* 126)

field winding; control tubes and transformers; a tap switch for matching ac voltage and four preset rheostats, which establish maximum and minimum motor-operating speeds, and which fix value of IR-drop compensation and determine motor acceleration; and a 45-sec warm-up timer. Another part of the control contains two to four grid-controlled tubes that supply motor-armature current. A third part of the control carries all starting, stopping, reversing, dynamic-braking, jogging and other contactors and relays. With this electronic unit, controlled starting, stopping and braking torques can be obtained and starting, stopping and reversing operations controlled from one or more points. *Reliance Electric & Engrg Co,* 1068 *Ivanhoe Rd, Cleveland, Ohio.*

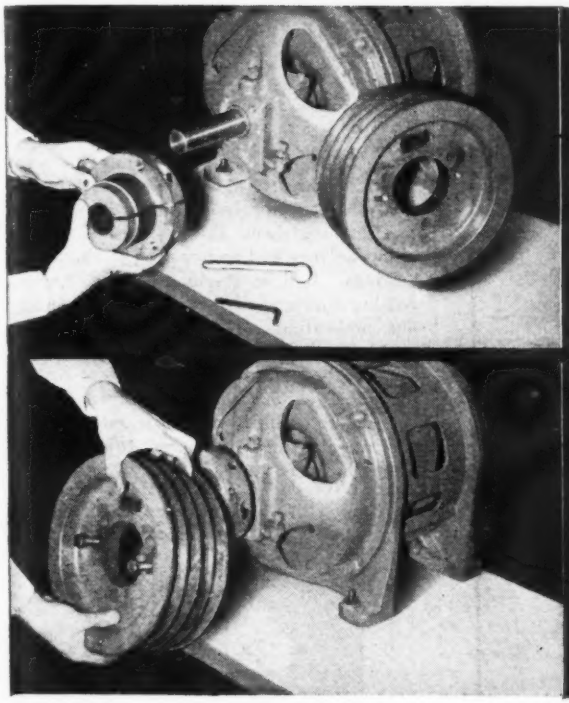
Electronic Relay

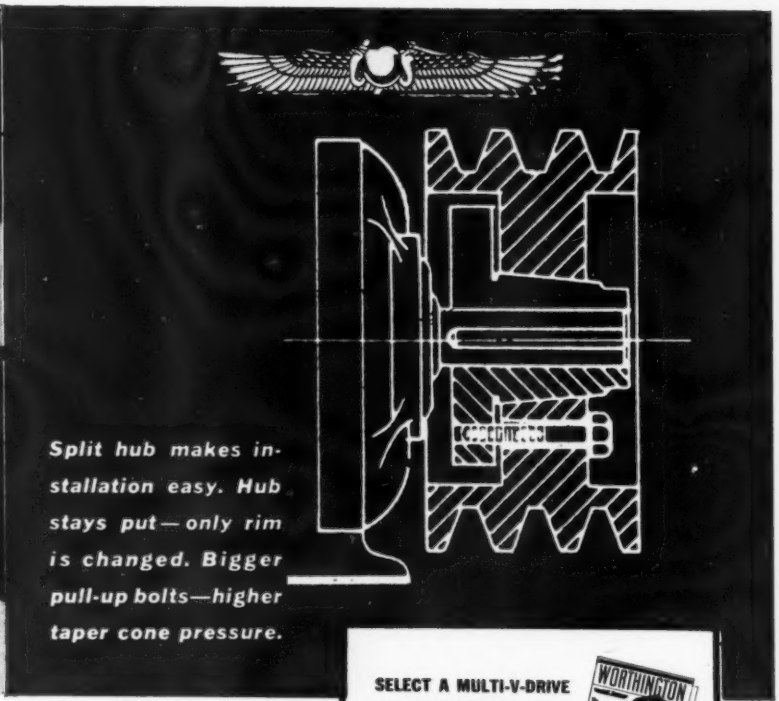
SMALL AND LIGHTWEIGHT, new electronic relay amplifies the limited current transmitted by delicate control contacts or high resistance circuits. Operated by any material having a resistance of from 0 to 500,000 ohms, or even greater if necessary, relay is for controlling liquid levels in tanks and boilers, as a limit switch requiring extremely light pressure to operate, etc. Relay consists of a standard electronic tube, supply transformer and electromagnetic relay—all mounted in a totally inclosed, weather-resistant inclosure for wall or machine mounting. *Industrial control div, General Electric Co, Schenectady, N. Y.*

Twin Pumping Unit

UNIT CONSISTS of two standard No. 50 pumps mounted on a cast bedplate and connected through semi-inclosed reduction gears to an electric motor. Pump constructions are all-iron, bronze-fitted or all-bronze. Capacity of each pump is 3 gpm at a discharge pressure of 100 psi. Pump speed is 570 rpm. Unit handles fuel oil, lube oil

NO OTHER SHEAVE HAS THESE 3 ADVANTAGES





Split hub makes installation easy. Hub stays put—only rim is changed. Bigger pull-up bolts—higher taper cone pressure.

Worthington's QD Sheave is easy to get on, easy to get off, yet always tight on the shaft

If you have ever been in the shop when old-fashioned sheaves were being changed . . . saw workmen sledging and prying and sweating to get one off and another on . . . got an earful of loose fits, tight fits, misalignment, then you'll appreciate these advantages of Worthington's QD sheaves.

With the QD, the hub stays put, because a variety of sizes of rims fit it. When changes are made for different speeds, the rim is easily removed and replaced. On all other sheaves, the hub has to be loosened, presenting a realignment problem when the hub is drawn up to the rim. Once you put on the hub of the QD sheave, alignment problems are permanently solved.

These advantages, plus those of the Worthington-Goodyear Endless Cord V-Belts, make the Worthington Multi-V-Drive the most trouble-free method of driving by V-belts.

Stock size sheaves and belts are available at strategic centers throughout the country.

SELECT A MULTI-V-DRIVE THE WORTHINGTON WAY with this simplified, easy to handle Master Manual

You can select the right drive to fit your job exactly in three minutes by the watch—using just plain everyday arithmetic.

Scientifically evaluated, after years of laboratory tests, all factors affecting V-Belt life and V-Belt efficiency were taken into consideration so that each selection is guaranteed to give peak performance under all conditions for which it is recommended.

This 72 page indexed manual does your Multi-V-Drive engineering for you. Be sure to get your personal copy.

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MV4-11

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Standard Products Div.
Harrison, N. J.

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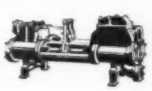
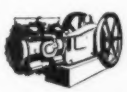
Rotary Pumps

Steam & Power Pumps



Vertical & Horizontal Compressors



Liquid Meters

Variable Speed Drives

Multi-V-Drives

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Standard Products Division
Worthington Pump and Machinery Corporation
Harrison, N. J.

Please send me a copy of the Worthington Master Manual.

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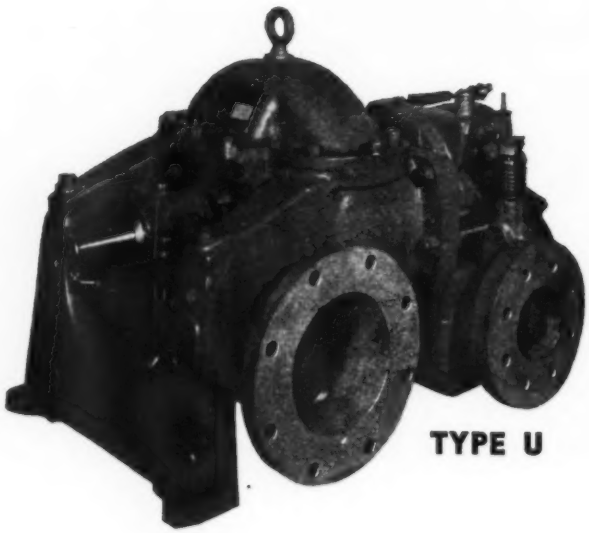
MURRAY

SINGLE STAGE TURBINES FOR MECHANICAL DRIVE



TYPE U

CENTER-LINE support and ample sized bearing reservoir shown by this three-quarter view are standard on Murray Type U Turbines, built in a variety of wheel sizes, with two-row and three-row impulse wheels, with all materials suitable for the operating conditions. May be obtained with any type of governor for either constant or variable speed. Ask for Bulletin T-118.

Other Murray Products

Turbine Generator Sets up to 2500 KW rating

Multi-stage Type UV Turbines

High speed Reduction Gears

Vertical Turbines

Steam Boilers

MURRAY IRON WORKS COMPANY

BURLINGTON, IOWA

Builders of Steam Power Equipment for Three Quarters of a Century

and similar liquids. These units will later be available in larger capacities and high pressures for applications where it is desirable to handle two different liquids through same pumping unit simultaneously. Similar twin units are now available with clutches to permit either alternate or simultaneous pump operation. *Blackmer Pump Co, Grand Rapids, 9, Mich.*

Aluminum Arc Welding

EUTECTRODE 2100 is a high-aluminum and low-silicon composition, which alloys itself to aluminum sheets and castings. Electrode allows salvage and reclamation of aluminum castings. Rod is shielded with a special coating which permits its application without preheating. It insures an even and rapid metal flow, according to maker, and slag can be removed by simply wire brushing the weld. Electrode is available in $\frac{1}{8}$- $\frac{5}{32}$- and $\frac{3}{16}$-in. sizes, packed in 25-lb packages. *Eutectic Welding Alloys Co, 40 Worth St, New York 13, N. Y.*

Electrical Pressure Switch

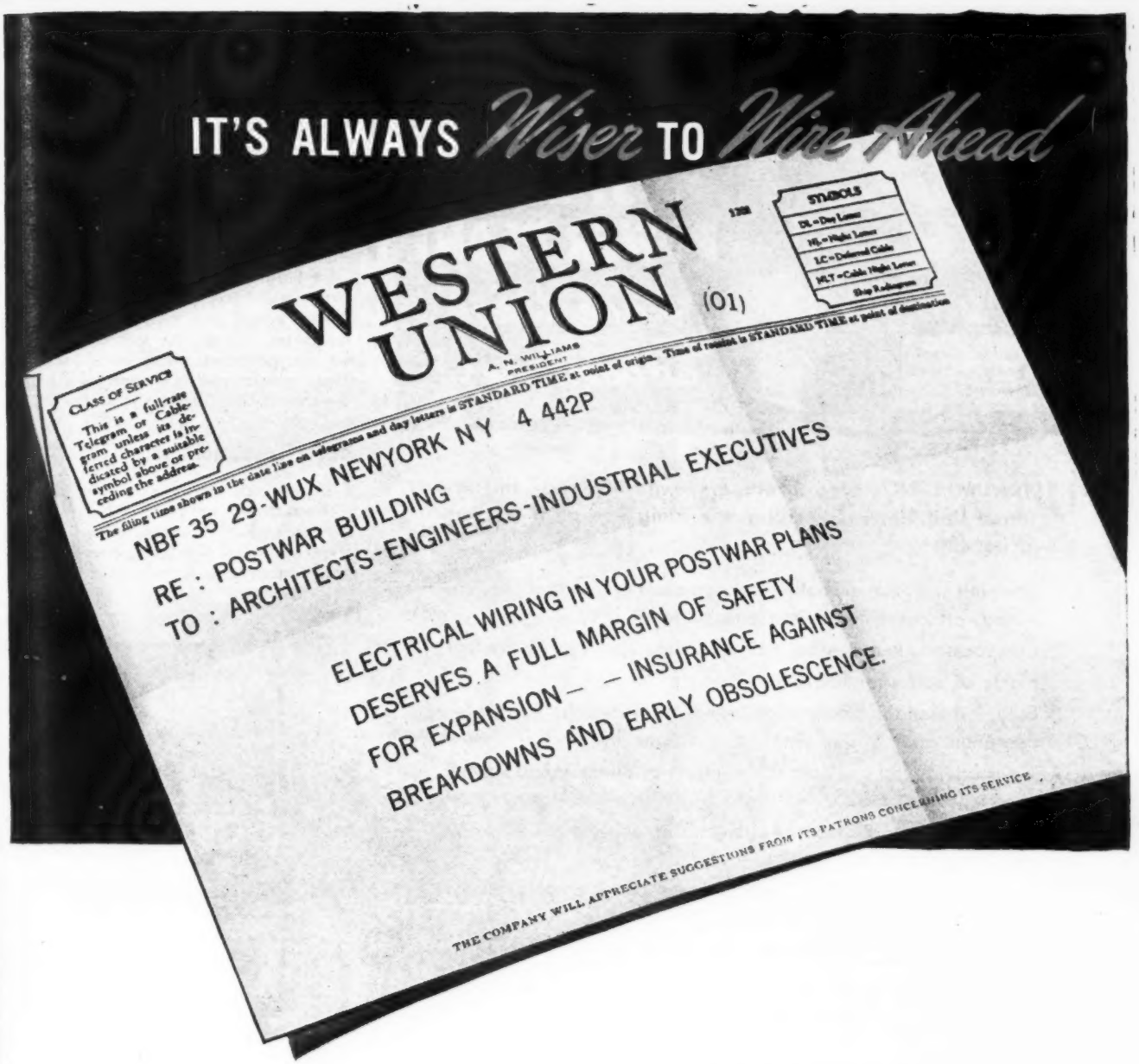
HERCULES ELECTRICAL PRESSURE switch has pressure ranges from 5 to 5000 psi. Device equipped with a direct-action gage for hydraulic pressures operating an electrical switch. Over-all dimensions are 10x7x3 in. *Hercules Electric & Mfg Co, 2416 Atlantic Ave, Brooklyn 33, N. Y.*

Seam-Welding Control

CONTROL FOR SEAM WELDING has a completely electronic timing circuit. CR7503-B110 resistance welding control is for operations where frequent changes of the timing pattern are required. Operating on a 230/460/575-v, single-phase, 60-cycle power supply, control consists of a timing panel, firing and heat-control panel and power panel, any one of which can be separately disconnected and removed to facilitate inspection or servicing.

Electronic circuit provides accuracy of timing pattern of weld without utilizing moving parts and regardless of normal, instantaneous or gradual line-voltage variation. Phase-shift method provides smooth

IT'S ALWAYS *Wiser* TO *Wire Ahead*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PLANNING POSTWAR HOMES? A new factory? A brighter, more bustling town? You'll want to take every advantage of the wonderful electrical devices of tomorrow.

So—Wire ahead! Make sure that your electrical system can handle the greatly increased load that it will surely be asked to carry.

While you're in the advanced planning stage consult with your engineer, electrical contractor and utility power engineer. Unwired planning will cost you a lot more than planned wiring. 44248

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ADEQUATE WIRING KEY TO VICTORY JOBS SERVES AND SAVES

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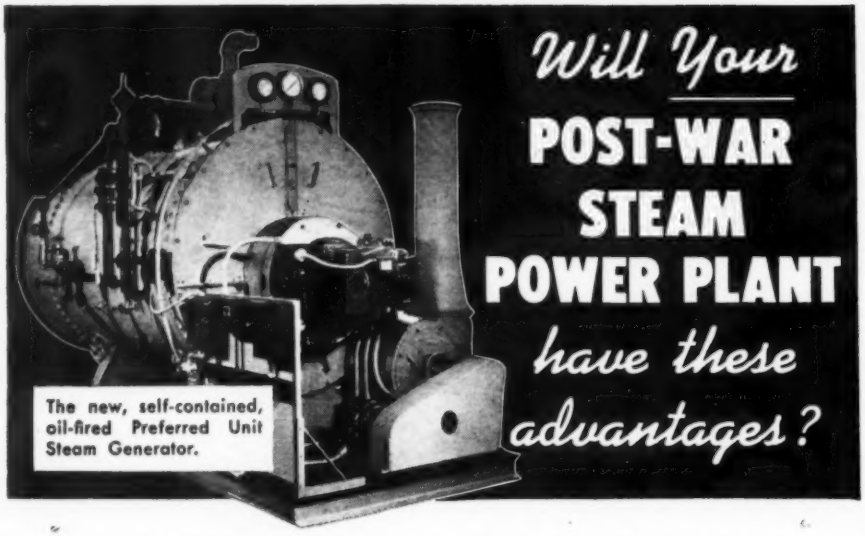

Will Your
POST-WAR STEAM POWER PLANT
have these advantages?

ULTRA-MODERN, keyed to economy-with-efficiency, this Preferred Unit Steam Generator will bring you *all* these combined benefits:

1. Completeness. Burner, boiler, induced-draft fan, controls, piping, wiring, all coordinated into one portable unit.
2. Compactness. Requires but half the space occupied by pre-war plants of corresponding capacity.
3. Easy installation. No special foundation needed. Ready for operation after a few simple connections.
4. Automatic operation. Calls for minimum of attention, no special experience needed.
5. High efficiency. 80%, as against a maximum of 60-65% efficiency of pre-war boilers.
6. Induced, "pull-through" draft. Requires no stack or chimney. Keeps boiler room free of combustion fumes.
7. Easy accessibility for cleaning. Flue doors removable.

Six-page folder giving full details, specification chart, typical performance graphs FREE. Send coupon.

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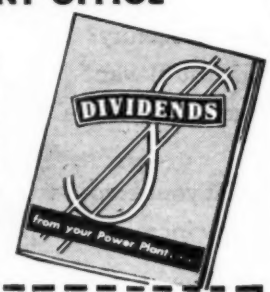
To arouse the management to the need of modernizing "duration" equipment—that's many an engineer's "headache." Here's a book—DIVIDENDS FROM YOUR POWER PLANT—written especially to give the executive the non-technical *business* facts about steam production. Interesting, common-sense facts he needs to know to understand the engineer's problems and value to him. 36 pages. All information—no advertising or sales talk. Free. Send the coupon.



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P-7-44

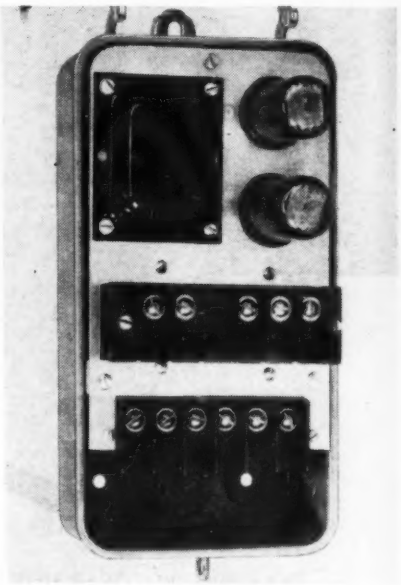
heat control. Indicating lights on front door show instantly whether water flow is adequate, power has been applied and time-delay has timed out. *General Electric Co, Schenectady, N. Y.*

Protective Skin Creams

CLAD SKIN PROTECTOR is made in two creams, for dry and for wet working conditions. Dry cream properties are said to eliminate skin drying or any tendency to cause burning or irritation. Dry cream protects exposed portions of body against dirt, grease, grime and other hard-to-wash-off substances. Cream for wet conditions is for skin protection where water and other dilute aqueous and mild chemical solutions are present. *B F Goodrich Co, Akron, Ohio.*

Water-Level Control

FARATRON, an electronic device, controls both water level and firing of boilers. Three electrodes of different lengths, mounted in a special fitting, directly connect to boiler. These electrodes connect, by a special

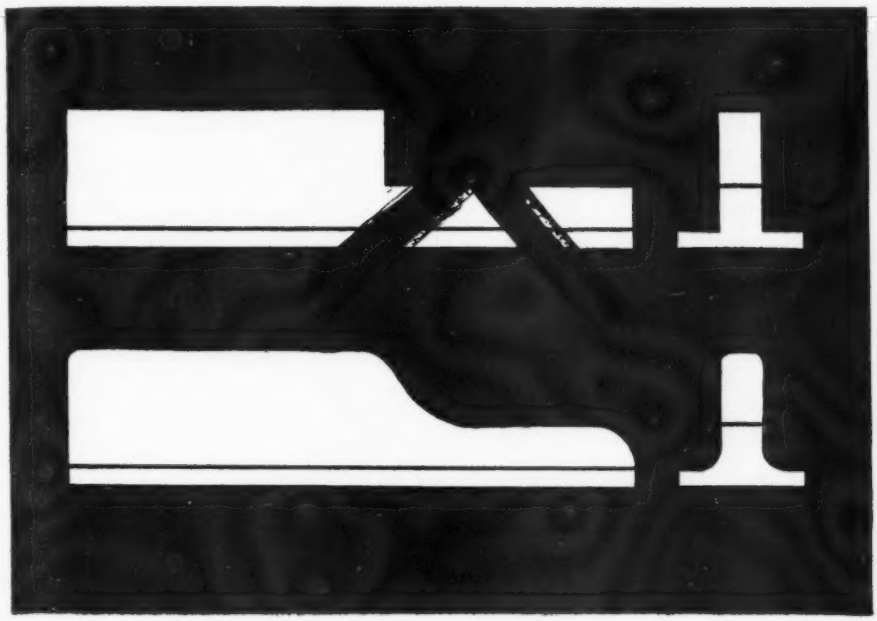


cable, with the electronic unit, which may be placed anywhere within 200 ft of boiler. When water in boiler drops below end of medium length or low-level electrode, feedwater intake valve opens automatically, or feedwater pump starts. Water flows in to boiler until it contacts short or high-level electrode when valve closes or pump stops. If water supply fails and boiler level leaves long or emergency electrode end, fire is extinguished by stopping fuel pump or by closing fuel valve. Then, an alarm, either bell, siren or light, is energized. *Lumenite Electronic Co, 407 S Dearborn St, Chicago.*

Frame Construction

A COMBINATION of Unistruts and Unistrut nuts and fittings provides three components necessary for construction of a frame for any object or for support of a number of objects. Unistrut is a square-formed steel channel having one side open in the form of a continuous slot. This square shape

GOOD STEEL CASTING DESIGN



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HERE, at Sivyer, we have been living with the hard-to-cast type of casting for over 34 years. This wealth of experience has often been very helpful to many buyers of castings. It has aided them in proper initial steel casting design . . . in the alteration and change of existing designs in the interest of obtaining greater strength, better casting results.

When you plan new steel castings, or the redesign of present ones — it will benefit you to consult Sivyer. Sivyer's casting "know-how" will enable you to get the most in better steel castings through better design.

SIVYER STEEL CASTING COMPANY
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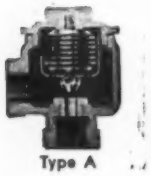
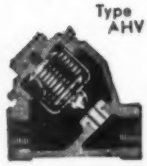
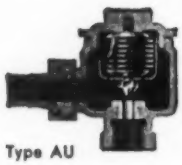
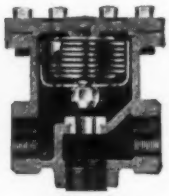
THE BIG 5 IN

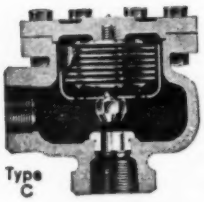

Type A


Type AHV

Industrial Thermostatic
STEAM TRAPS


Type AU


Type B


Type C

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NO AIR-BINDING — Discharge air as efficiently as water.
NO FREEZE-UPS—Designed to drain when cold.
NO ADJUSTMENT, for any pressure.
NO WATER-LOGGING—A few degrees difference between steam and condensate opens valve.
NO DRIBBLING — Intermittent action; wide open when cold.

★ Five types.
★ Sizes ¼" to 2"
★ 2 to 6 times greater valve area
★ Pressures to 225 lbs.

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Write for Bulletin 800 which gives complete information about Viking Pumps widely used today in the power equipment field. It's FREE.

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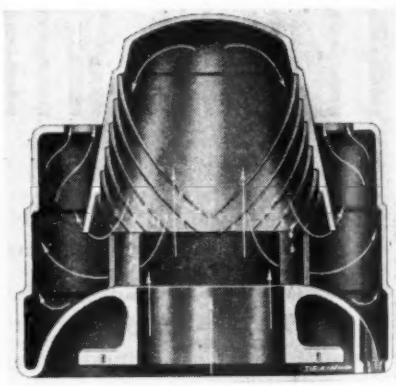
provides flat surfaces to work with and various members may be revolved to any 90-deg position for bolting. It can be cut to desired lengths on the job if necessary, to form the skeleton for all objects of construction within scope of its strength, and without the necessity of locating holes or drilling them. *Unistrut Corp, Wayne, Mich.*

Process Timing Mechanism

TAYLOR PROCESS TIMING DEVICE, built into either single-duty Fulscope recording temperature or pressure controllers, is again available. Because it is designed for the Fulscope case, user derives advantages of five interchangeable forms of Fulscope control: fixed high sensitivity, adjustable sensitivity, adjustable sensitivity with automatic reset, adjustable sensitivity with pre-act and automatic reset. *Taylor Instrument Companies, Rochester, N. Y.*

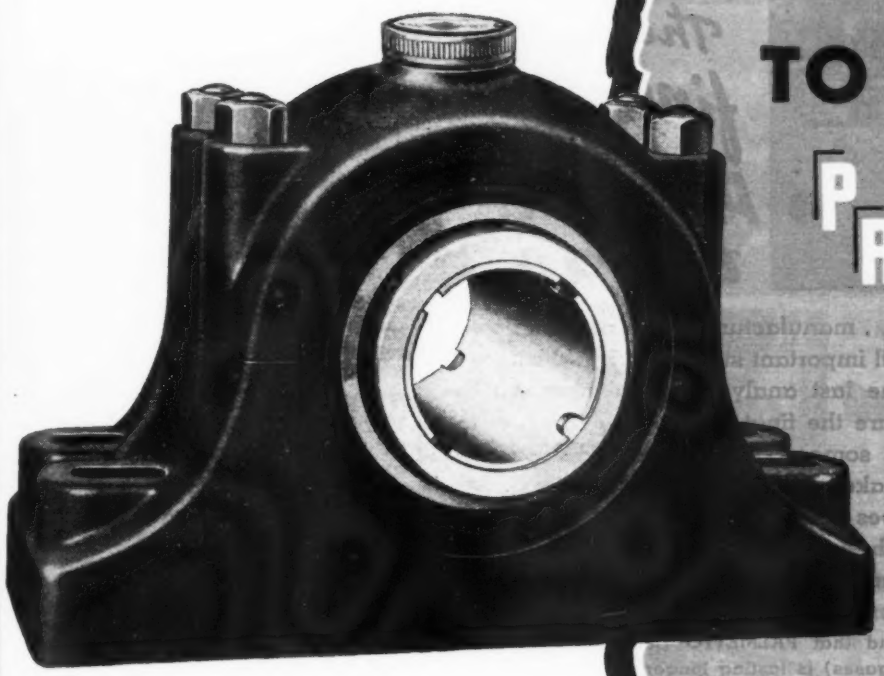


Exhaust Head

FF FREE-FLOW EXHAUST HEAD, embodying Wright-Austin principles for complete separation of oil and water from exhaust steam, is said to have two special advantages: (1) By removing all moisture before steam is blown out, it wholly eliminates water spray. (2) It eliminates objectionable noise ordinarily associated with exhaust head operation.

Directional valves or ribs are cast on inside of head to collect and carry separated moisture and oil out of steam flow. For complete elimination of these contaminants, normal steam velocity is slowed down by a

GETTING POWER TO THE JOB PROFITABLY



Dodge Special Duty Adapter Type Pillow Block equipped with Timken Bearings. Manufactured by Dodge Mfg. Corp., Mishawaka, Ind.

Power transmission equipment designed to take advantage of Timken Tapered Roller Bearings — like Dodge lineshaft hangers and pillow blocks for example — presents many economies to far-sighted plant managers.

It reduces power consumption; simplifies lubrication and saves lubricant; prevents shaft wear; and greatly curtails involuntary power interruptions.

Another important advantage and one that merits particular mention, springs from the fact that Timken Bearings can be sealed so effectively that leakage of lubricant — and consequent danger of product contamination — is entirely preventable.

Timken Bearing Equipped power transmission units also have a favorable influence on driving belt life by preventing shaft eccentricity — and thereby helping to prevent pulley wobble.

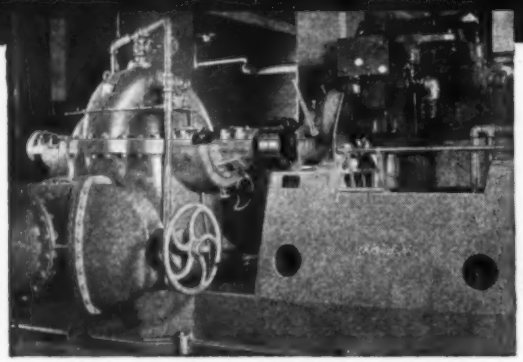
Obsolete transmission equipment is a constant threat to production in many plants; is it in yours? A check-up is indicated. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

PERFORMANCE . . .



The final test of **PACKING** *value*

Materials . . . construction . . . manufacturing skill and care . . . experience . . . these are all important standards by which to judge a packing; but in the last analysis, actual service records are the final test.

Here are some records of G-T Packing service, taken at random from our files. Space does not permit more than a few, but we shall be glad to give additional details on services similar to your particular conditions:

"We find that PALMETTO (for steam, hot water, gases) is lasting longer and holding tighter with less friction than any of the numerous packings we have ever tried."

●

"With packings previously used, pump shaft sleeves had to be replaced every three months. Do not notice any wear since changing to PALCO (for cold water) four years ago."

●

"PELRO (for solvents, oils) has exceeded our wildest hopes in preventing leakage without increasing shaft temperature, and shows the greatest dependability we have ever found in any packing."

●

"SUPER-CUTNO (for acids) is giving us double the service of other packings formerly used."

Performance records like these PROVE that you, like thousands of other Engineers all over the world, will find that G-T Packings can materially reduce your operating costs.

THIS IS THE **8th** of a series explaining why G-T PACKINGS give better service.

8 REASONS for the Superiority of G-T Packings

1. **SIMPLE LINE** . . . makes correct selection easy
2. **COMPLETE LINE** . . . an exactly suitable type for every service.
3. **SELF LUBRICATING** . . . each individual strand saturated with lubricant
4. **SPECIAL LUBRICANTS** . . . lubricant for each service specially compounded in our own plant
5. **SELECTED YARNS** . . . provide tensile strength and resist high temperature
6. **CONSTRUCTION** . . . assures maximum endurance, longest life, lowest friction
7. **EXPERIENCE** . . . 80 years of manufacturing experience
8. **PERFORMANCE** . . . proven in thousands of plants of every type

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PALMETTO *for steam, hot water, air.* PALCO *for water.* PELRO *for oils.* CUTNO *for alkalis.* SUPERCUTNO *for acids.* KLERO *for foods, etc.* PALMETTO SUPERSHEAT **PACKINGS**

G-T *self-lubricating* **PACKINGS**

2-stage expansion of steam—first in the dome and again in the body surrounding the dome. As a result, only *dry steam* passes out through exhaust head. Outlet opening, much larger than intake pipe area, permits purified exhaust to escape easily, without back pressure. This feature is said to assure practically silent operation. Exhaust head is for all pipe sizes from 1½ to 14 in., standard or *tailor-made* to meet individual conditions. *Wright-Austin Co, 330 W Woodbridge St, Detroit 26, Mich.*

Electronic Preset Speed Control

A SYSTEM OF ELECTRONIC program control gives any desired number of speeds from a variable-voltage controlled dc motor, preset on a series of dials. Rate of change from one operating speed to another can be controlled. Speed selection handled by limit switches or similar devices for opening and closing circuits. This unit, in effect, is a simple electronic grid-controlled rectifier using a fixed displaced ac rider voltage in the control-grid circuit. This voltage is superimposed on a dc voltage, the sum of an adjustable positive voltage and a

feedback negative voltage from the generator armature of the variable-voltage-control set. At steady speed, a control voltage is established that maintains required generator output voltage. To increase speed, speed-control rheostat increases positive grid voltage. A small increase in this voltage produces full tube output for generator excitation instead of just enough for the higher required speed. This action forces generator flux and voltage to increase motor acceleration rate, after which the control reduces acceleration rate as the motor pulls into final speed. During retardation, lowering the control voltage causes negative feedback voltage to kill generator exciting current, and its field flux decays at a rate depending on circuit constants. Upon reaching motor preset speed, grid circuit voltages again balance and field-tube conduc-

MACMILLAN RING-FREE WILL DO A BETTER LUBRICATING JOB

MAKE US PROVE IT!

MACMILLAN RING-FREE MOTOR OIL

MACMILLAN PETROLEUM CORPORATION

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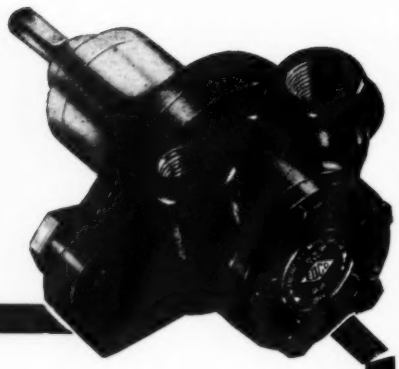
EDCO ROTARY PUMPS



VANE TYPE
PATENTED CONSTRUCTION

At high or low speeds . . . whether creating a 28" vacuum or developing extremely high pressures . . . the vanes of EDCO Pumps maintain effective spanning position without springs or centrifugal action.

Fuel transfer pumps, coolant pumps and motor-driven assemblies. Furnished in capacities from 2 GPH up, in any required corrosion-resisting material. Operates silently at all speeds. Minimum maintenance required. Used for fuel oils and other fluids of any specific gravity.

FOR COMPLETE DATA . . . write today. Ask for Bulletin 936.

EDDINGTON METAL SPECIALTY CO.

P. O. Box K **Eddington, Pa.**

Design and estimating by competent engineers who recommend the materials best suited to the type of service for which the work is intended . . .

Sensible methods of manufacture in completely equipped shops . . . Prices in line with built-in Downingtown quality . . . Consultation of a nationally famous metallurgical authority available on every job . . .

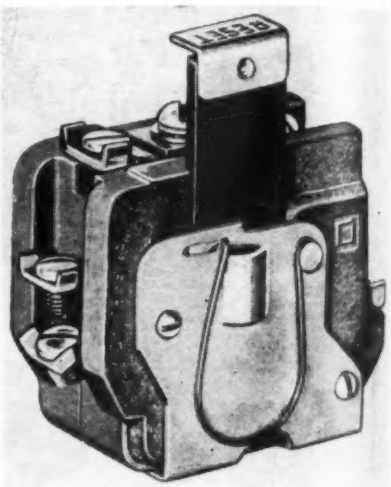
Over 30 consecutive years' experience in Metal fabrication . . . *It is not unusual that repeat orders were over 70% of our 1942-43 business.*

DOWNINGTOWN IRON WORKS
DOWNINGTOWN, PA.
HEAT EXCHANGERS

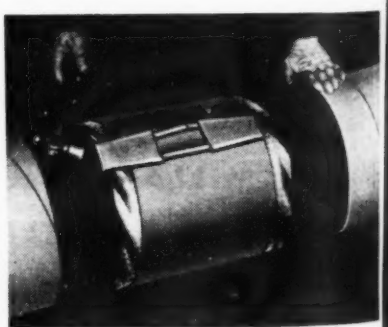
tion starts at an angle that maintains a generator voltage to give preset motor speed. This control can be applied to all variable-voltage drives, but is particularly adapted to applications requiring a series of selected preset speeds. *Reliance Electric & Engrg Co, 1068 Ivanhoe Road, Cleveland, Ohio.*

Overload Relay

BIMETALLIC OVERLOAD RELAY provides an easy yet positive method of changing from automatic to hand reset. An unusual feature is a simple means of adjusting the tripping point from 85% to 115% of nominal rating. Thus, changes may be made in settings for variations in ambient temperature or load conditions at motor. Overload



protection is not limited to usual selection of heater sizes since intermediate points can be obtained. AR relays, designed for separate mounting or front mounting on size 0 and 1 starters, are needed whenever starters are mounted in remote or inaccessible locations. *Industrial controller div, Square D Co, 4041 N Richards St, Milwaukee 12, Wis.*

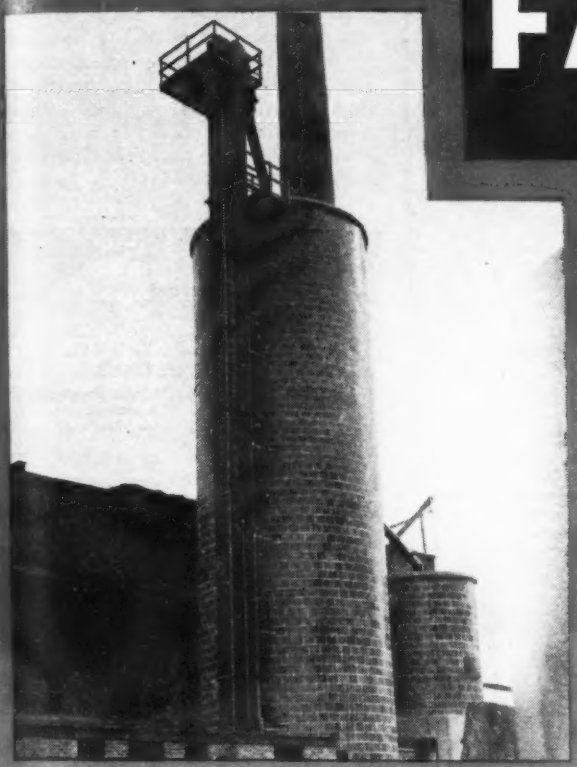


Prefabricated Conduit Coupler

SIMPLIFIED COUPLER, for mechanical or welded closure, is said to speed field assembly of Ric-wiL prefabricated conduit. After pipe has been coupled or welded and insulation applied over exposed portions, smoothed conduit ends are coated with waterproof sealing cement. Heavy-gage split connector sleeve is then slipped over opening. Clamps are driven onto wedge-shaped channels over lapped joint, quickly making a strong watertight mechancial coupling. Where a welded closure is required, cement

The Modern Method of Coal Storage and Handling

FAIRFIELD
SILO SYSTEM



• The Fairfield system of coal and ash storage and handling is engineered for the specific installation. It is designed, built and erected under the guiding hand of one organization.

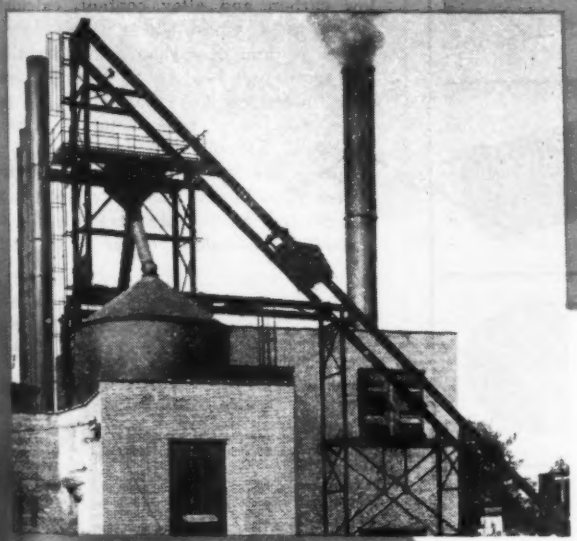
That's why it is so versatile—it provides the type of equipment you want—does the job the way you wish it done.

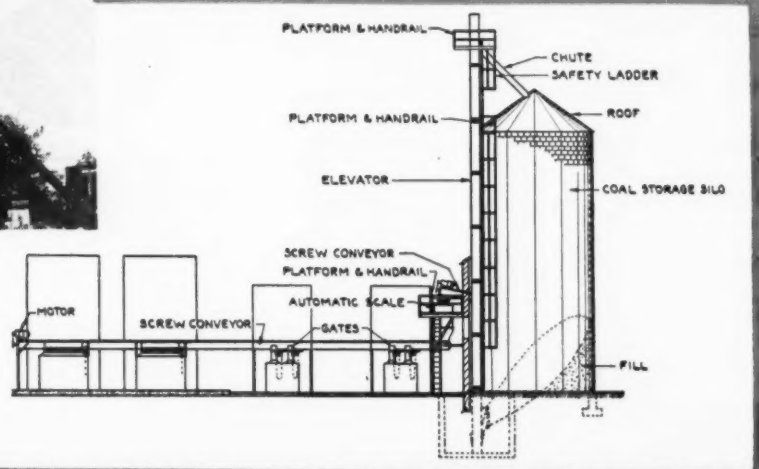
For example at the upper left is shown two Fairfield vitrified hollow tile silos—one for the storage and handling of coal the other for ashes. The circular design provides maximum storage in minimum space. The vitrified hollow tile keeps moisture out—protects the coal—and location outside boiler house keeps dirt and dust outside.

The handling of coal from car, to storage, to stokers or pulverizers is automatic and handling of ashes from boilers to storage is also automatic.

At the lower left is a Fairfield Skip Hoist handling 50 tons of coal an hour . . . it distributes the coal to two cylindrical steel bunkers, each having a capacity of 100 tons. This illustrates another very satisfactory Fairfield method of coal handling.

Consult a nearby Fairfield Engineer on your coal and ash handling problems. A fully descriptive bulletin is available on request.



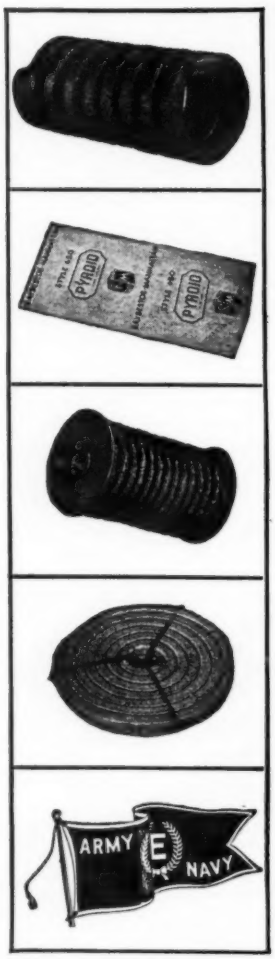


At the right is a diagram of a Fairfield silo system incorporating a screw conveyor feed for distributing coal to stokers. Larry systems are also available for this operation.

THE FAIRFIELD ENGINEERING CO.- MARION, OHIO

BUILDERS OF COAL AND ASH HANDLING EQUIPMENT

R/M—A PISTON-PACKING PAPA



For over forty years, R/M packings have been meeting the demands of scores of different industries, under almost every possible service-condition. Laboratory and research work have further developed them to withstand the added strains of war production. The result is the most durable and efficient line of packings and gaskets ever made. As the demand for war equipment relaxes, the greater economy and outstanding performance of R/M products will again be available to everyone.

INDUSTRIAL SALES DIVISION
RAYBESTOS-MANHATTAN, INC.
MANHEIM, PA.
BRIDGEPORT, CONN. NORTH CHARLESTON, S. C. PASSAIC, N. J.
Makers of Packings for Every Industrial Use

is omitted and sleeve ends lap-welded to conduit after clamps have been applied. For extra strength, clamps may again be driven onto channels after weld is made.

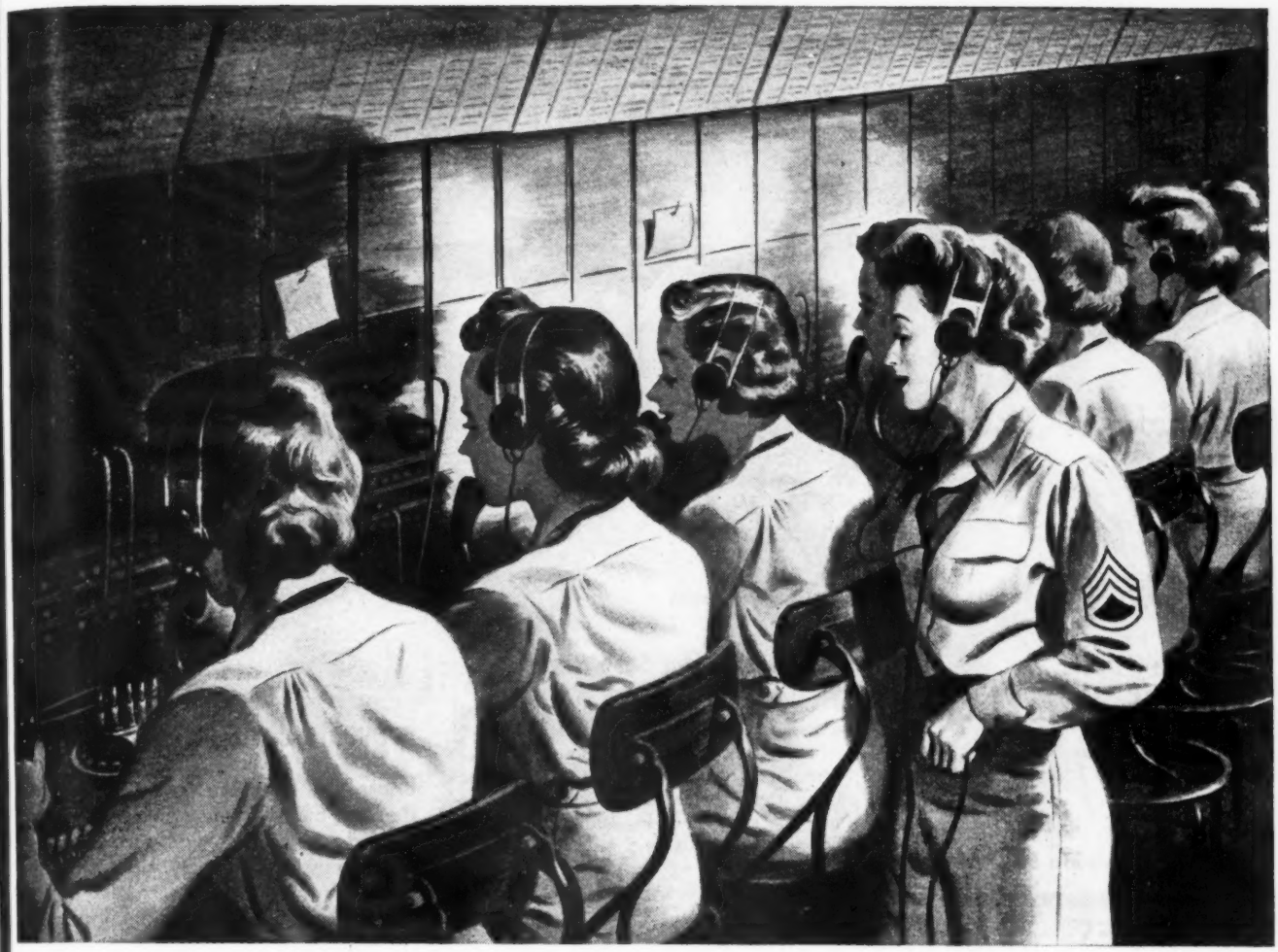
When conduit coupling is completed, an asphalt blanket, applied with heat over entire closure area, fuses with factory applied asphalt, which is said to assure uniform protection at all points. Accessories for complete system, including expansion loops, elbows, tees, anchors, reducers, etc, are prefabricated and equipped with same drive coupler for assembly with conduit sections. *Ric-wiL Co, 1572 Union Commerce Bldg, Cleveland, Ohio.*

Welding Preheat Calculator

ALTHOUGH MOST STEELS are readily weldable and require no preheating because of low carbon and alloy content, calculator serves as a guide where steels have a higher content of carbon and other alloys and require preheating to minimize tendency toward excessive hardening and possible cracking of base metal adjacent to the weld. Lincoln calculator, 6¼ in. in diameter, consists of four movable sections of heavy cardboard. Complete instructions are printed on outside sections. *Lincoln Electric Co, Cleveland, Ohio.*

Voltage Tester

INSTRUMENT TESTS without lamps, gives positive voltage identification and distinguishes between ac and dc. Voltage markings are 110, 220, 440 and 550 for ac and 125, 250 and 600 for dc. Frequencies



NICKEL AIDS THE COMMUNICATIONS INDUSTRY

to KEEP 'EM IN TOUCH!

In the tradition of Morse and Bell and Marconi, the communications engineer carries on today.

His work, always valuable, now is vital.

No military campaign proceeds without it. The close teamwork between air, ground, and sea arms is possible only through instruments and equipment that keep them in touch though scattered throughout the four quarters of the globe.

And the vastly increased pace of modern war production brings with it increased use of every home-front circuit, line and wave-length.

All branches of the communications industry ... telephone, telegraph, radio ...are *meeting* the tremendous demand for their products. In war, communication engineers are taking advantage of their long peacetime experience with metals and alloys.

Time and time again this experience has shown them that a little Nickel goes a long way in improving other metals.

So now, when the dependability of what this industry makes is of supreme importance to the Nation, it favors more than ever the use of Nickel.

In repeaters, relays, magnetos, loading coils, transformers, loud-speakers and modern cables...even in the molds that form plastic radio parts...they call upon Nickel and its alloys for several unique advantages.

When other metals lack toughness, Nickel often supplies it. When they lack strength and fatigue resistance or corrode too easily, adding Nickel provides the needed qualities. Under abrasion, wear, shock and stress metals perform better *with* Nickel than *without*.

In the communications industry, as in many another, the knowledge, experience and cooperation of our staff has been at the disposal of technical men. Whatever *your* industry may be...if you want help in the selection, fabrication, and heat treatment of alloys... similar counsel and data are at your service.

Catalog "C" makes it easy for you to get Nickel literature. It gives you capsule synopses of booklets and bulletins on a wide variety of subjects — from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?

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THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N.Y.*

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ADAMANT
FIRE BRICK CEMENT

It F-L-O-A-T-S
Through the Air

"Air-Floating" . . . one step in the manufacture of Adamant drops out the larger, coarser particles and leaves only the basis for a finer, smoother cement. So uniformly smooth is Adamant that it permits the highly desirable thin joints that weld the brick together . . . joints as strong as the brick they bond.

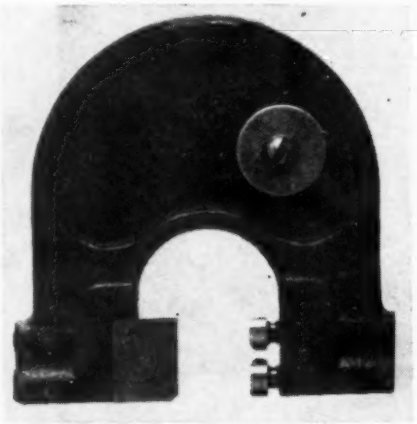
Use Adamant for longer lasting linings in boiler furnaces, forging and heat treating furnaces. Reduce maintenance and rebuilding costs.

Adamant is one of an extensive line of Adaproducts . . a refractory for every purpose. Write for literature and name of nearest dealer.

BOTFIELD
REFRACTORIES COMPANY

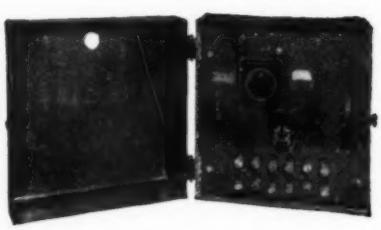
784 S. Swanson St., Philadelphia 47, Pa.
In Canada, Canadian Botfield Refractories Co., Ltd., 171 Eastern Avenue, Toronto

can be determined by indicator vibrations. Sharp spear points on lead ends permit piercing of wire insulation for testing without damage. Tester locates open circuits, blown fuses or motors running single phase. *Square D Co,* 6060 *Rivard St, Detroit* 11, *Mich.*



Adjustable Limit Snap Gages

FOUR MODELS of adjustable limit snap gages, known as midget gages, have been added to line. Company states they are manufactured in accordance with American Gage Design Standards and are designed for checking and inspecting small and delicate parts. Midget gages may be set to handle work from .000 to .760 in. *George Scherr Co,* 128 *Lafayette St, New York* 13, *New York.*



Current-Regulating Compensator

CONTROL IS SPECIFICALLY DESIGNED to facilitate consistent welds by holding the rms, or true heating value, of weld current constant for any heat-control setting, without requiring continual manual adjustment. After predetermined heat-control setting for a particular job has been made on the compensator, it requires no further adjustment. Compensator consists of an electronic-control circuit which automatically retards or advances firing point of ignitron tubes for controlling welding current, thus holding current constant regardless of line voltage changes or welding conditions. Housed in steel inclosure, compensator may be mounted on or near welding machine. It may be applied to most GE resistance-welding controls which incorporate phase-shift method of heat control. *General Electric Co, Schenectady, N. Y.*

BRICKSEAL

★ Highly-glazed monolithic coating prevents cracking and spalling

Brickseal will reduce to a minimum the danger of untimely failure of boiler refractories. This widely-used refractory coating, applied like paint with brush or spray gun, forms a highly-glazed, heat-reflecting, monolithic, protective surface which prevents damage due to cracking, spalling, slagging, air infiltration and sudden temperature variations.

Brickseal should not be confused with ordinary air-set washes which form a plaster-like surface coating. Brickseal consists of high-fusion clays and metals combined in oils. Furnace heat burns the oils and vitrifies the clays and metals, which penetrate deeply into all pores, cracks and joints, binding the bricks into a durable, monolithic wall.

Brickseal cannot crack, blister or peel off due to sudden temperature changes because, at operating temperatures, it becomes semi-plastic, permitting it to expand and contract with the wall. Brickseal also binds old cracked or loosened bricks. Clinkers may be removed without damage to lining.

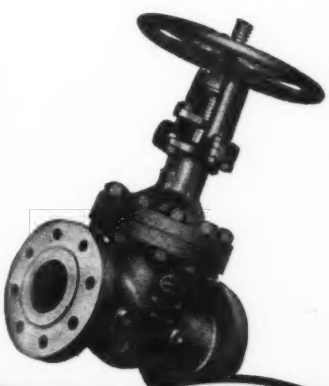
You can secure Brickseal protection with very little cost or delay. Write for sample today.

BRICKSEAL
REFRACTORY CO.
1029 CLINTON ST., HOBOKEN, N. J.

We've Spilled the WORKS!

All the works—two discs and two wedges—four parts—the entire working part assembly of a Darling Double Disc Gate Valve. The seats are parallel. The discs are *fully revolving,* seating in a different position *each time* the valve is operated. This means tighter seating, less wear, longer operation, and lower maintenance costs with Darling Gate Valves. All four working parts are uniform and positive in action. They are simply designed, with no pockets to collect sediment or prevent free and easy movement. Any part can be replaced quickly and inexpensively without removing the valve from the line. They cannot be incorrectly assembled or become disengaged while in service. It's an assembly that will more than pay its way in your plant.

At your service are the engineers of the Darling Valve & Manufacturing Company. They can solve your valve problems without cost or obligation to you. Wire or write, setting appointment at your convenience.



Darling manufactures a quality line of longer-lasting Gate Valves. They come in Fully Revolving Double Disc, Parallel Seat, also in Taper Seat—Slotted and Solid Wedge types. In service pressures up to 3000 pounds, available in Cast Iron, Bronze, Forged Steel, Cast Steel, and Corrosion Resistant Alloys. Darling also manufactures Compression Type Fire Hydrants, Check Valves, Motor and Cylinder Operated Valves, and many accessories.

TRADE DARLING MARK

VALVE & MANUFACTURING CO.

WILLIAMSPORT, PA.

INTERCHANGEABILITY

THE wide interchangeability of parts designed into "Renewo" and "Ferrenewo" valves has long proved a boon to maintenance men in making their job easier.

Since valves control the very life lines of productive processes —steam, air, water, oil, gas and other fluids—it follows that every precaution be taken to insure proper functioning.

Regular checking and inspection, and prompt servicing when necessary, will be repaid in more efficient performance and longer valve life, and may well prevent possible shut-down of equipment for more costly repairs later.

The simplicity of design of "Renewo" and "Ferrenewo" valves, with interchangeable parts, makes it easy to keep them in good operating condition, with minimum expenditure for maintenance.

Lunkenheimer distributors are located in all industrial centers. Use the facilities of the one nearest you for service on your requirements.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

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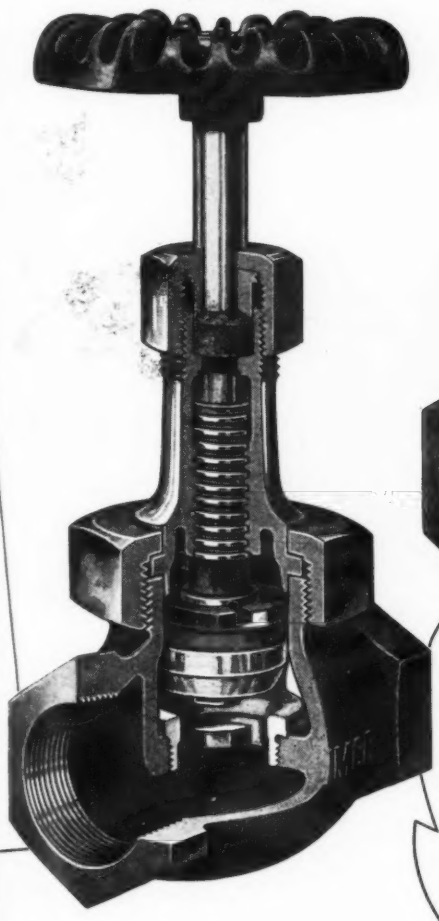
LUNKENHEIMER

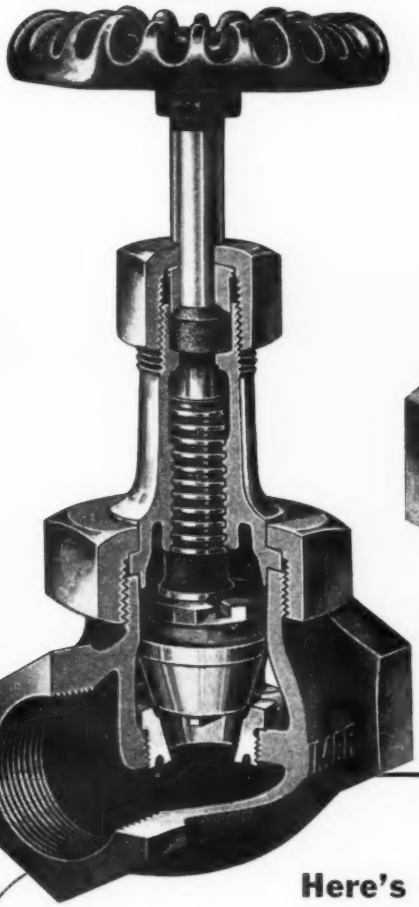
Speeds Maintenance

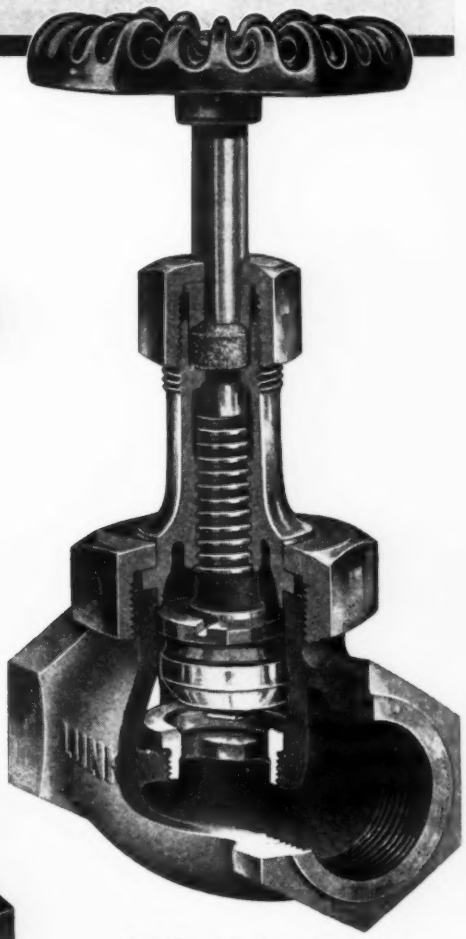
SIMPLICITY OF DESIGN
MEANS
EASIER MAINTENANCE

200 lb. S.P. Bronze
"RENEWO"
Regular Type



200 lb. S.P. Bronze
"RENEWO"
Plug Type





150 lb. S.P. Iron Body
"FERRENEWO"
Regular Type

Here's how Interchangeability Speeds Maintenance . . . . .

All parts of the valves illustrated above, with the exception of bodies and bonnet rings, fit each other perfectly.

If, for example, you need a stem, disc, or seat ring for the "Renewo" and do not have it available you can use the corresponding part of the "Ferrenewo"—*it is exactly the same.* This means fewer parts to be carried, speedier repairs and greater ease in making them.

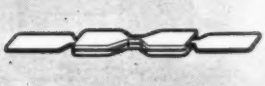
The same flexible interchangeability likewise applies between the various 300 lb. S.P. "Renewo" valves.

R VALVES BOILER MOUNTINGS
LUBRICATING DEVICES

No. 102-96-42

"In SEVEN YEARS

WHY BUSS FUSES DON'T BLOW NEEDLESSLY



10 FEATURES in the design of the FUSE-CASE help make it possible.

and

The SUPER-LAG development in the FUSE-LINK completes the job.

BUSS

only one blown fuse on our Trimmer after we *installed* BUSS Super-Lag"

Says **MR. FRANK MILLER, CHIEF ELECTRICIAN**
STRATHMORE PAPER COMPANY
WEST SPRINGFIELD AND WORONOCO, MASSACHUSETTS

HERE ARE THE FACTS —"In June, 1937, we installed a paper trimming machine which is powered by a 7½ horsepower, 440 volt, 3 phase motor. Almost immediately, we had trouble with fuses blowing when we started the machine.

"Then we installed BUSS Super-Lag fuses—and in seven years *we have had only one blow to date.* That proved to me the value of time-lag in fuses. Since then we have gone 100% to BUSS fuses in our 2 plants each at West Springfield and at Woronoco—and our fuse blows have been reduced by at least 30%."

In the Strathmore Paper Company plants, Buss Super-Lag fuses have again proven their ability to withstand harmless surges when motors are started under heavy load—without over-fusing the circuit. With these fuses, you can eliminate many needless shutdowns—yet have adequate protection.

Buss fuses require no maintenance or periodic inspection. They don't open needlessly. If one opens, you can be sure some condition needs correction. When one opens, it requires less than 45 seconds to renew with an inexpensive link.

Here is Why BUSS Fuses Greatly Reduce or Entirely Prevent Needless Blows

The fuse case is designed to insure good contact on the link, even when the fuse is renewed by an inexperienced person—and it is so designed that vibration or heavy overloads or the constant heating and cooling of the fuse will not permit poor contact to develop. Thus excessive heating, which causes fuses to blow needlessly, is prevented.

The fuse link used is the famous "BUSS Super-Lag." It has lag-plates attached to it. These give a long time-lag so that unusually heavy starting current or other harmless overloads will seldom cause the to blow.

How to solve the "shutdown" problem

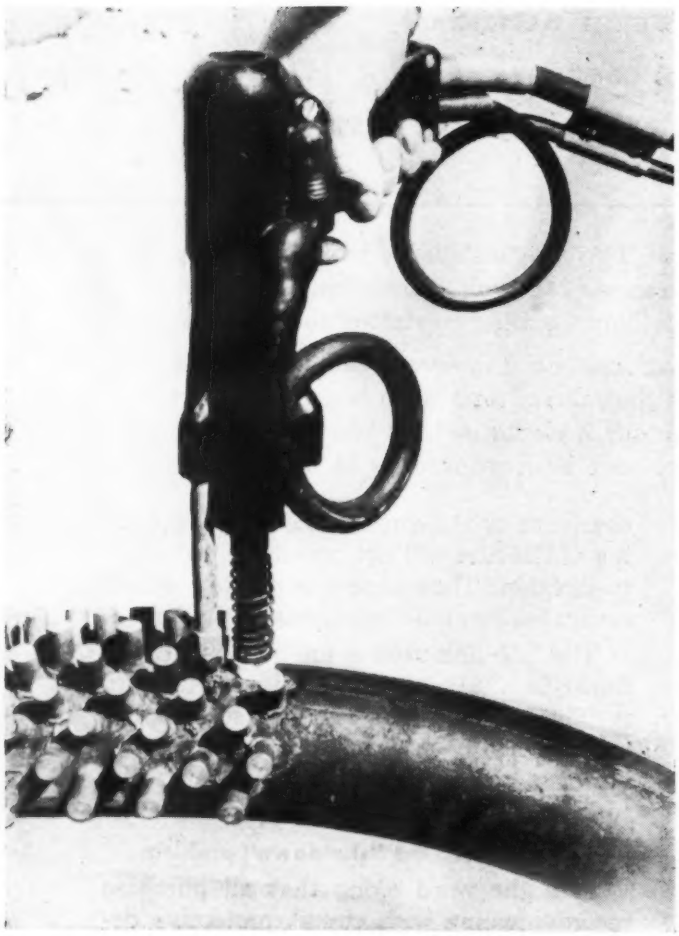
Pass the word along that all purchase records dealing with circuit protective devices should be immediately changed to call for BUSS Super-Lag Renewable fuses. Then, as fuses are replaced or new installations made, your plant will automatically get the benefit of the carefree, trouble-proof protection that BUSS Super-Lag fuses afford.

BUSSMANN MFG. CO. • University at Jefferson, St. Louis 7, Mo.
Division McGraw Electric Company

SUPER-LAG FUSES
SOLD THROUGH WHOLESALERS

DAMAGED BOILER TUBES NOW QUICKLY REPAIRED

★ *Nelson Stud Welder automatically welds studs on boiler tubing in less than 1/2 second!*

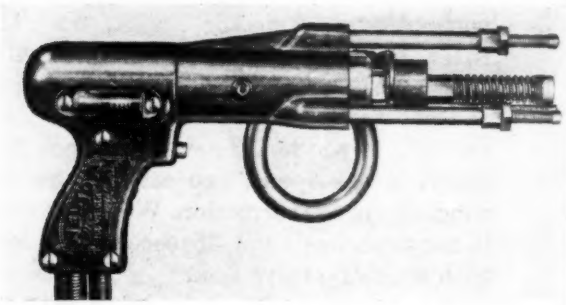


Studs are welded on lines scribed on tube before welding . . . 1¼″ apart on 19° centers. The stud is placed in the chuck, the gun positioned, and the trigger pulled to complete the weld. The gun is then reloaded with another stud and the next weld is made.

Using the Nelson Stud Welder two women welders recently welded 13,000 studs on new boiler tubes in 18 hours! One welder and a helper studded an average of 24 feet of tubing in 8 hours! These are not special tests, but time checks made on regular production jobs.

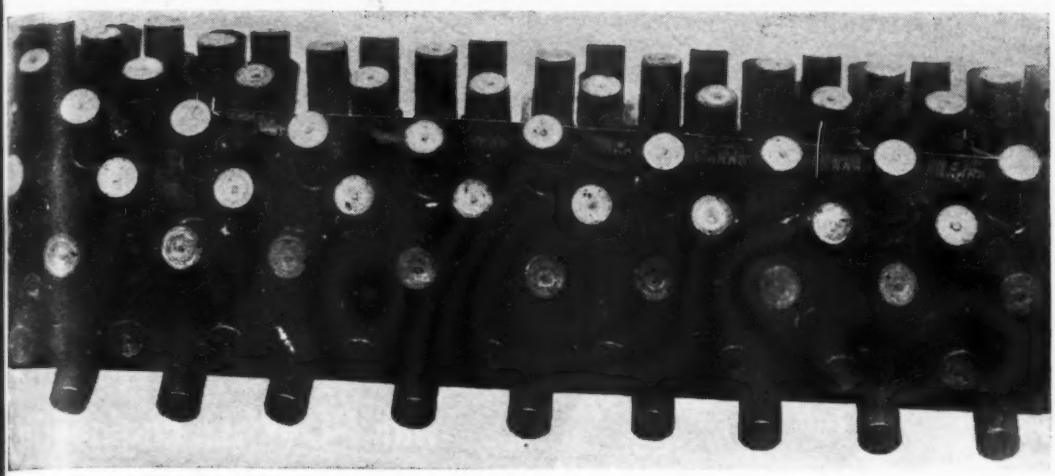
The Nelson Stud welder will make your boiler maintenance problem easier. No need to have your boiler out of operation for one to three months . . . no need to stock a large inventory of special tubes. Repair it at your plant.

The accompanying photographs represent a typical installation recently completed for a large power company. Write today for complete details on how you can use the Nelson Stud Welder!

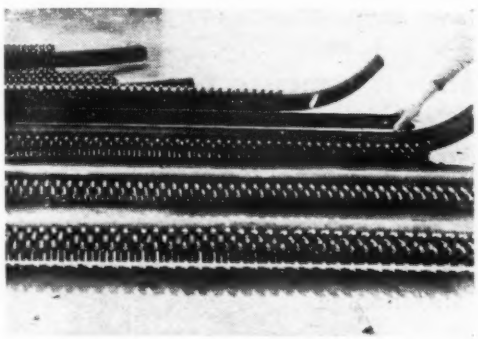


The Nelson Stud Welder is fully automatic and is easy to operate. Proven by 5 years of usage, it is today used in over 300 industries and shipyards throughout the United States and Canada.

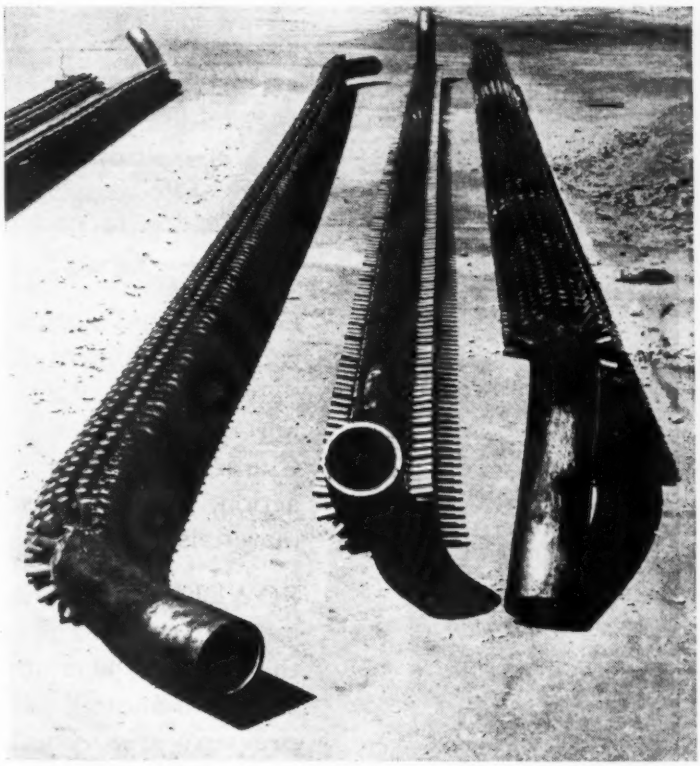
THE NELSON AR



Studs illustrated are ½" dia. x 1⅛" length. The strength of the weld is equal to the strength of the stud. *Complete fusion results between the stud and the tube!*



Perfect alignment of the stud is easily obtainable with this flexible stud welding unit.



Completed tubes demonstrate the uniformity of Nelson Stud Welding. You will find many other uses for this product in your maintenance program. Wherever there is need to end weld stubs to metal or secure parts, it may be easily used!

CATALOG & SAMPLES

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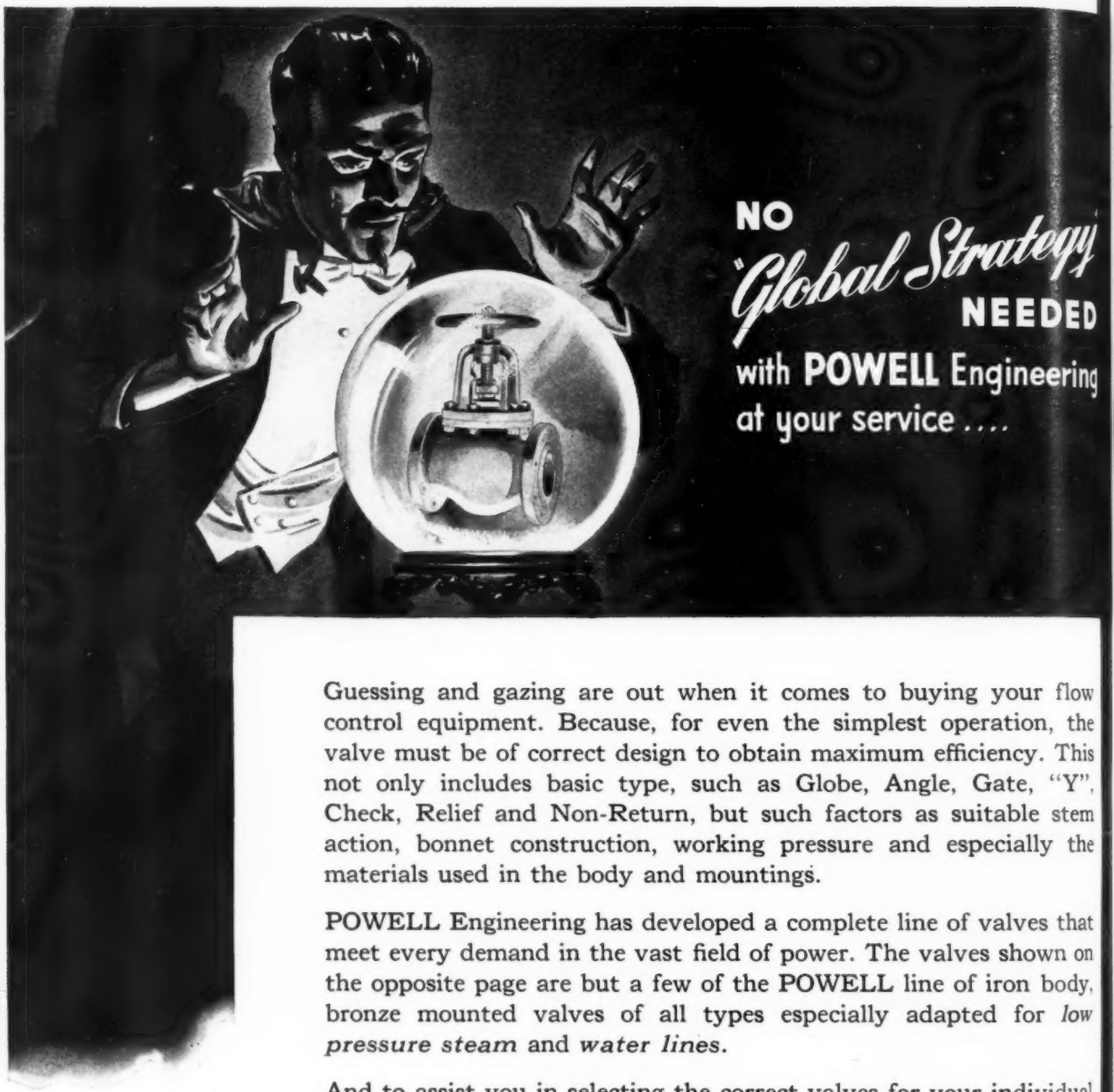
Eastern Representative: Camden Stud Welding Corp., Camden, N. J.

STUD WELDER



Guessing and gazing are out when it comes to buying your flow control equipment. Because, for even the simplest operation, the valve must be of correct design to obtain maximum efficiency. This not only includes basic type, such as Globe, Angle, Gate, "Y", Check, Relief and Non-Return, but such factors as suitable stem action, bonnet construction, working pressure and especially the materials used in the body and mountings.

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Fig. 559—Large Size Iron Body Bronze Mounted Swing Check Valve for 125 pounds W. S. P. Has flanged ends, bolted flanged cap with ample number of bolts, and regrindable, renewable bronze seat and disc. Sizes, 2" to 16", inclusive.

Fig. 241—Iron Body Bronze Mounted Globe Valve for 125 pounds W. S. P. Has flanged ends, outside screw rising stem, bolted flanged yoke bonnet and regrindable, renewable bronze seat and disc.

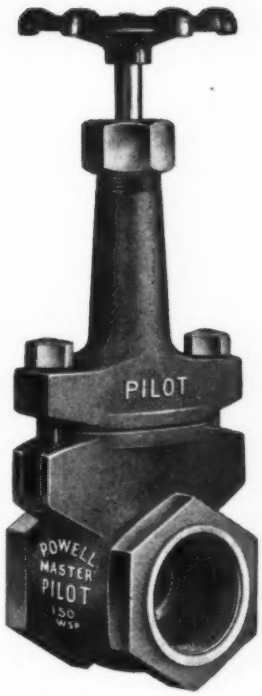

Fig. 1460—Iron Body Bronze Mounted "Master Pilot" Gate Valve, with screwed ends, inside screw rising stem, bolted flanged bonnet and taper wedge solid disc. Sizes, ¼" to 2", inclusive, for 150 pounds W. S. P.; 2½" to 4", inclusive, for 125 pounds W. S. P.

Fig. 190—Iron Body Bronze Mounted "Irenew" Globe Valve for 150 pounds W. S. P. Has screwed ends, inside screw rising stem, union bonnet and regrindable, renewable "Powellium" nickel-bronze seat and disc. Sizes, ¼" to 3", inclusive.

Fig. 1793—Large Size Iron Body Bronze Mounted Gate Valve for 125 pounds W. S. P. Has flanged ends, outside screw rising stem, bolted flanged yoke and taper wedge solid disc. Sizes, 2" to 30", inclusive. Also available with taper wedge double disc—Fig. 1444.

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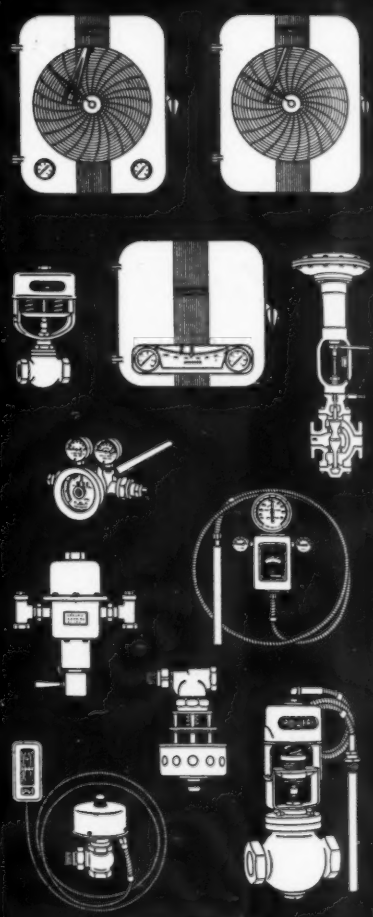

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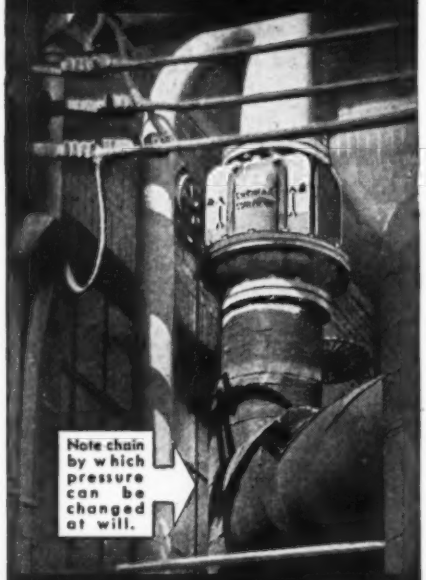

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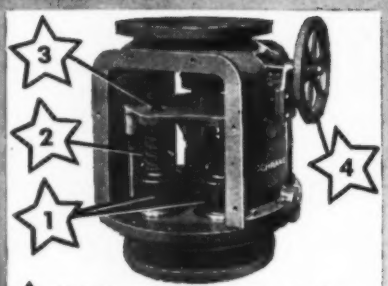

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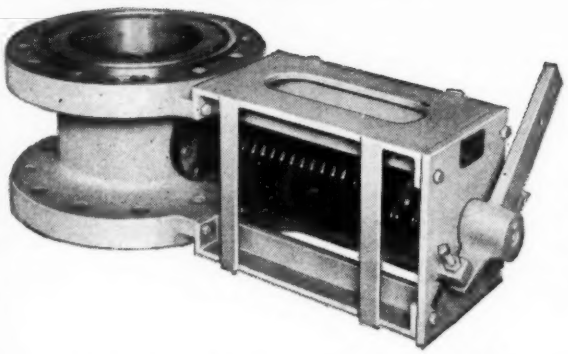

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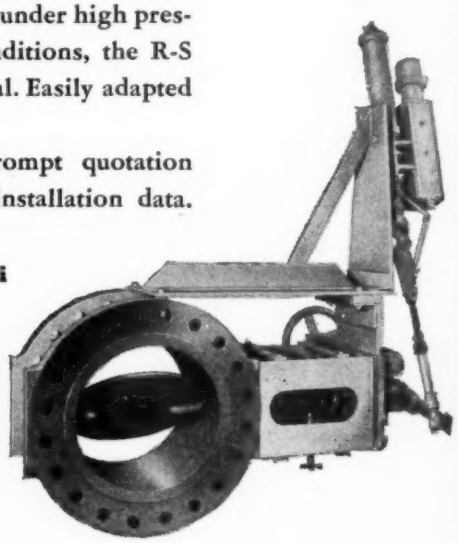

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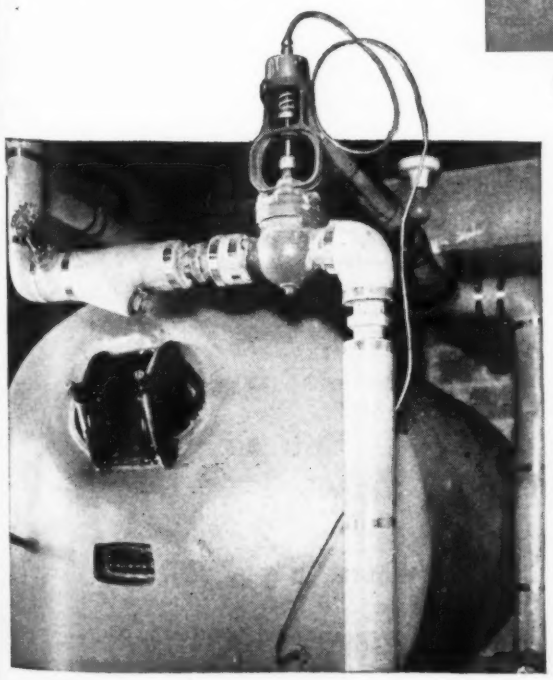

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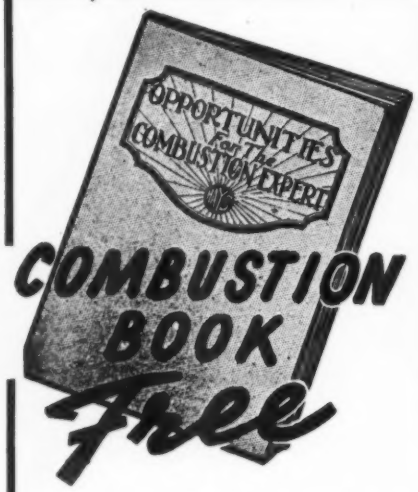

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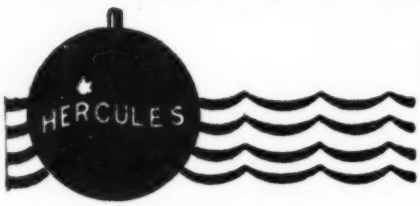

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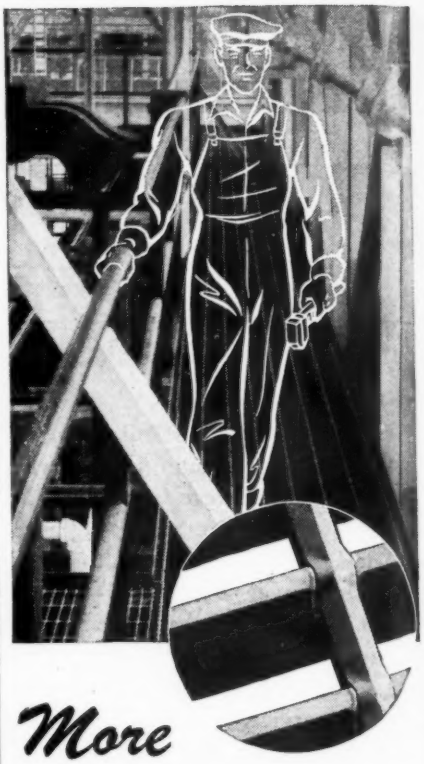

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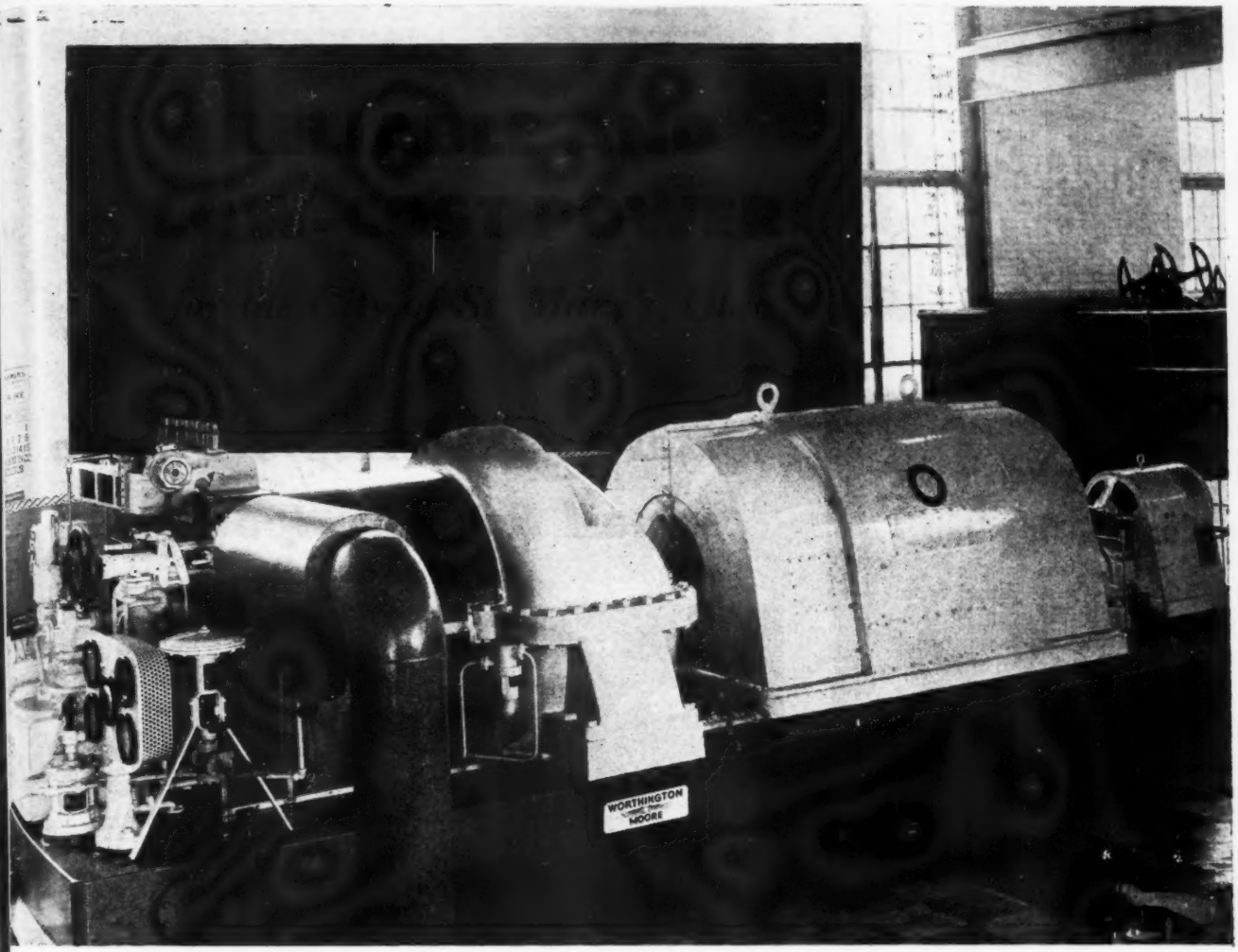

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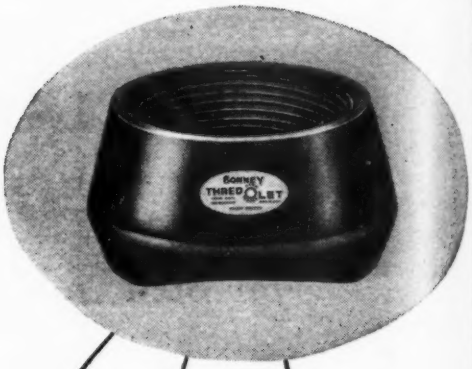
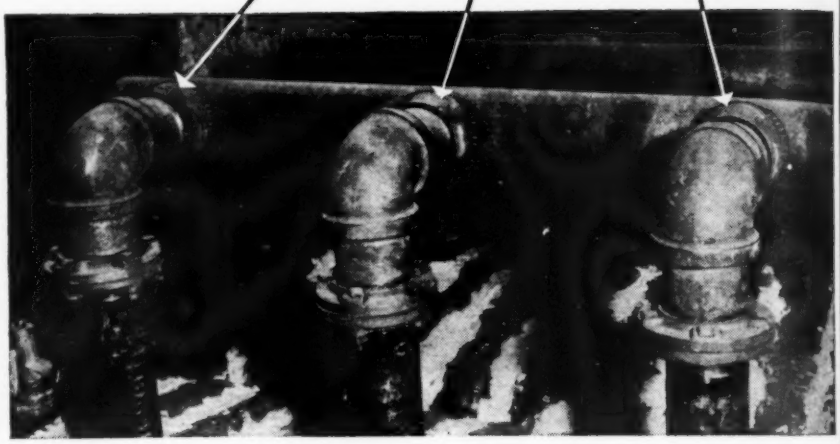


Here's the simple way to install branch pipe outlets



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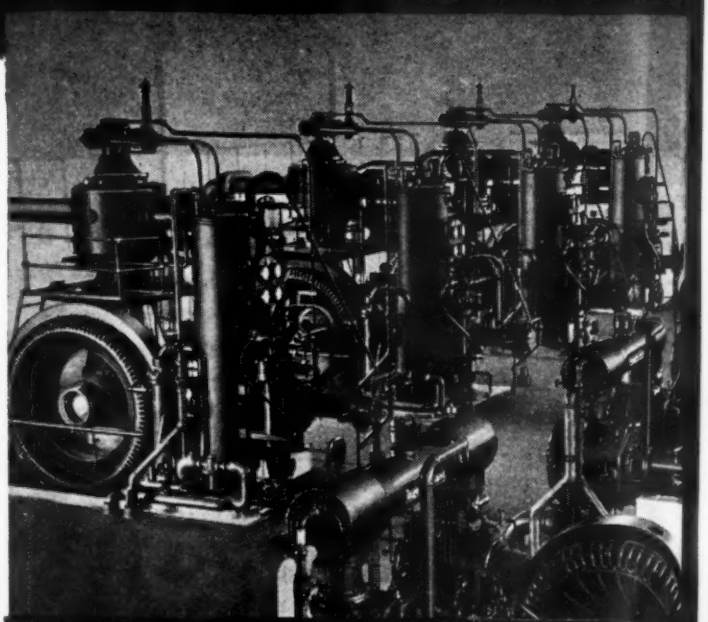

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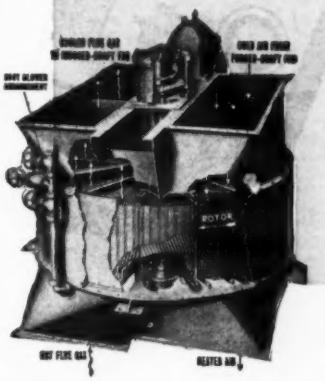

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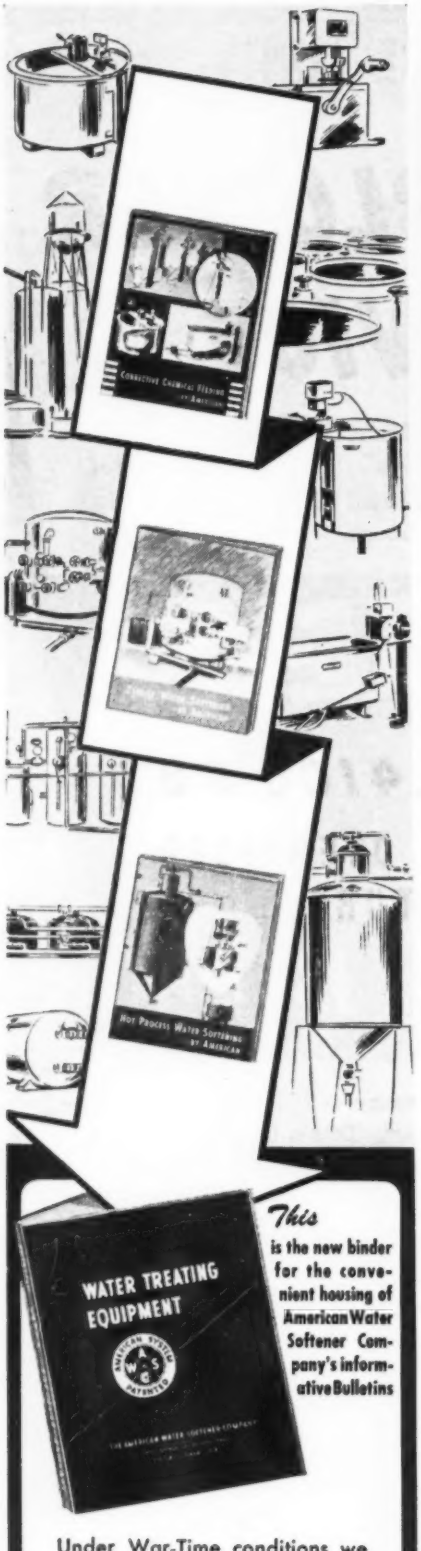

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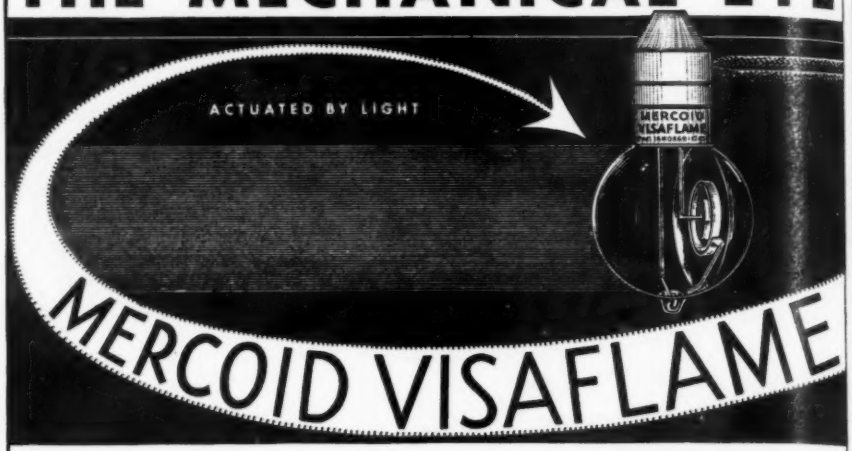

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Feedwater Chemistry
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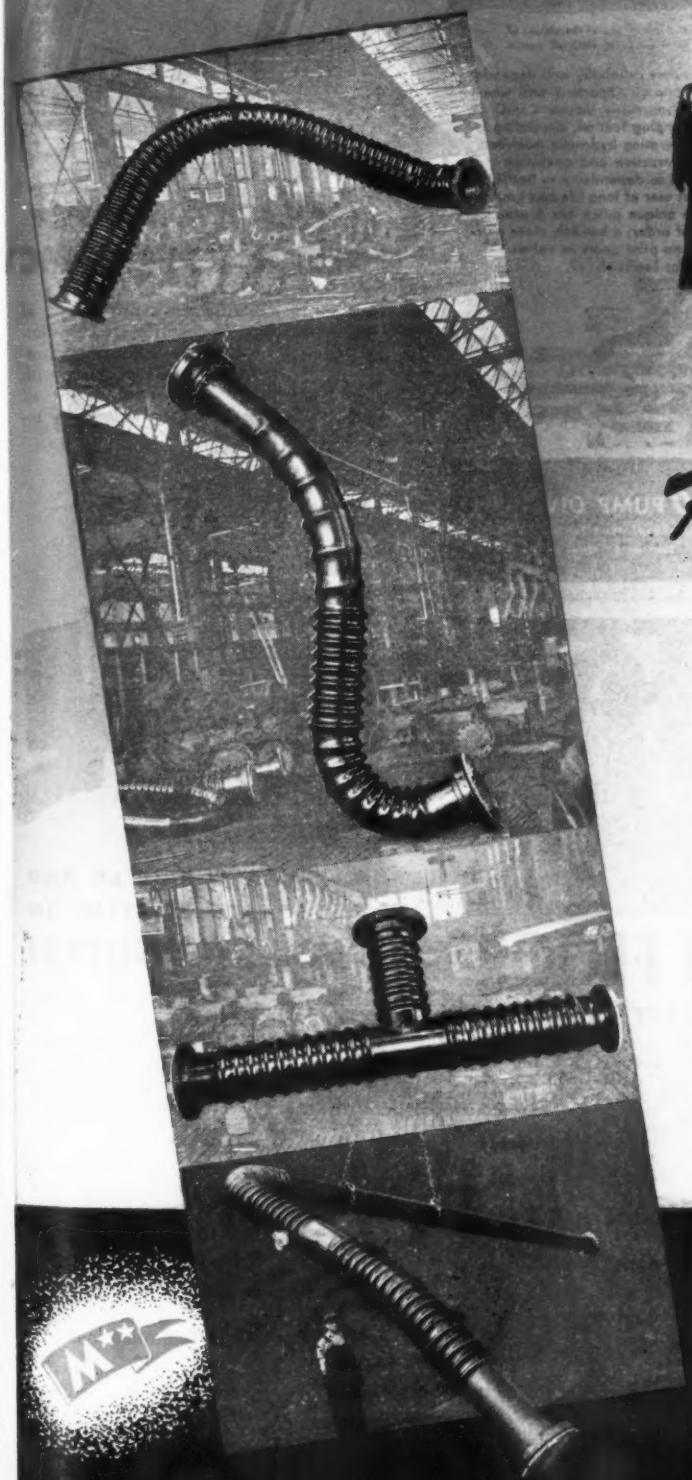

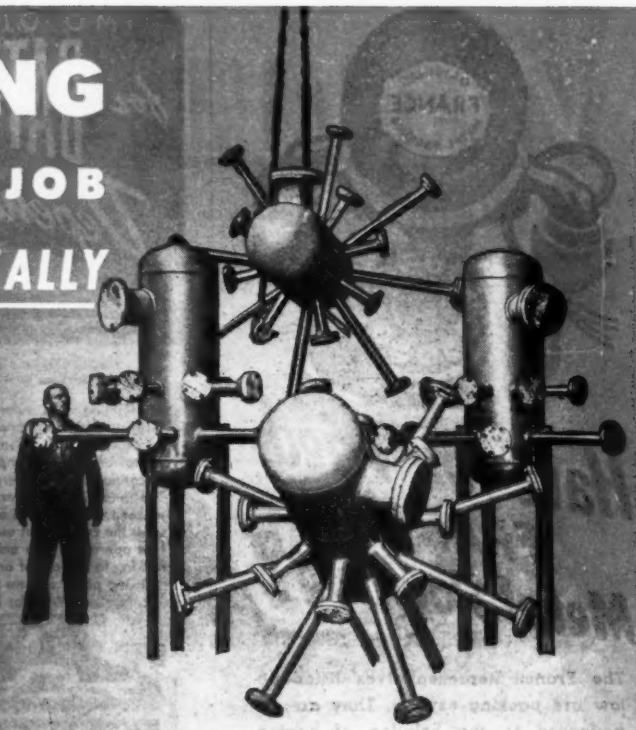

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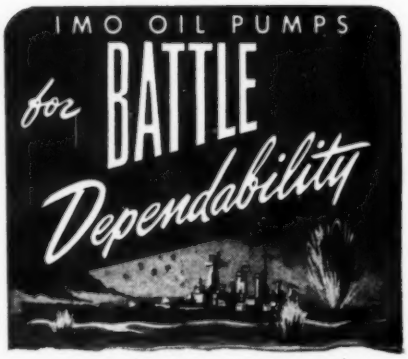

A cruiser of the U. S. Navy, one of the classes of ships equipped with De Laval-IMO oil pumps

On fighting ships, where reliability and dependability under strain are all important and where space is at a premium, many thousand IMO oil pumps are in use pumping fuel oil, circulating lubricating oils, and operating hydraulic machinery. The simplicity of construction and operation that makes the IMO pump so dependable in battle assures the commercial user of long life and trouble-free operation. This unique pump has practically nothing to get out of order; it has only three moving parts, and no pilot gears or valves.

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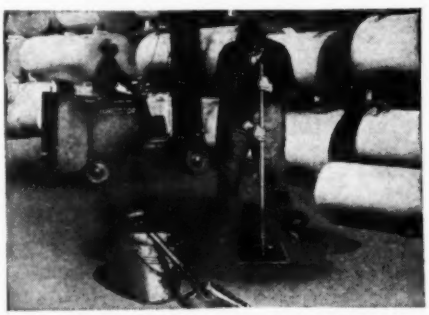

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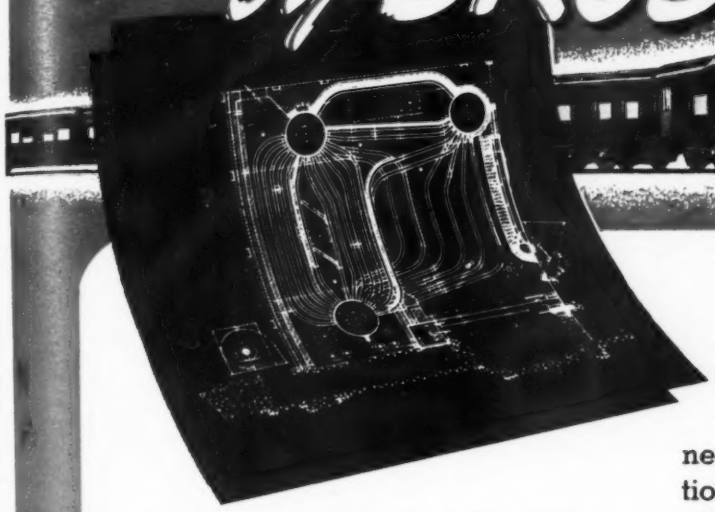

● The war-time task of the Pullman Company continues to be a tremendous job. Nearly half of its 7000 mobile cars are constantly engaged in the transportation of servicemen—an average of 30,000 troops moving and sleeping in its cars every night. Pullman and the railroads are carrying a war-time passenger load three to four times as great as in the average years preceding the war—and this is being done with very little expansion in facilities.

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From the Bros Company, a single source of supply with undivided responsibility, Pullman obtained a complete installation of one unit of modern equipment, consisting of Bros 3 drum Water-tube Boiler with air cooled walls, Bros Super-Spred Stokers and combustion control system, complete boiler instruments and other accessories.

If you have a power problem, involving a new installation or revision of present plant, it will pay you to consult Bros. Resident representatives serve all markets. Detailed literature on Bros boilers and Spreader Stokers will be mailed promptly.

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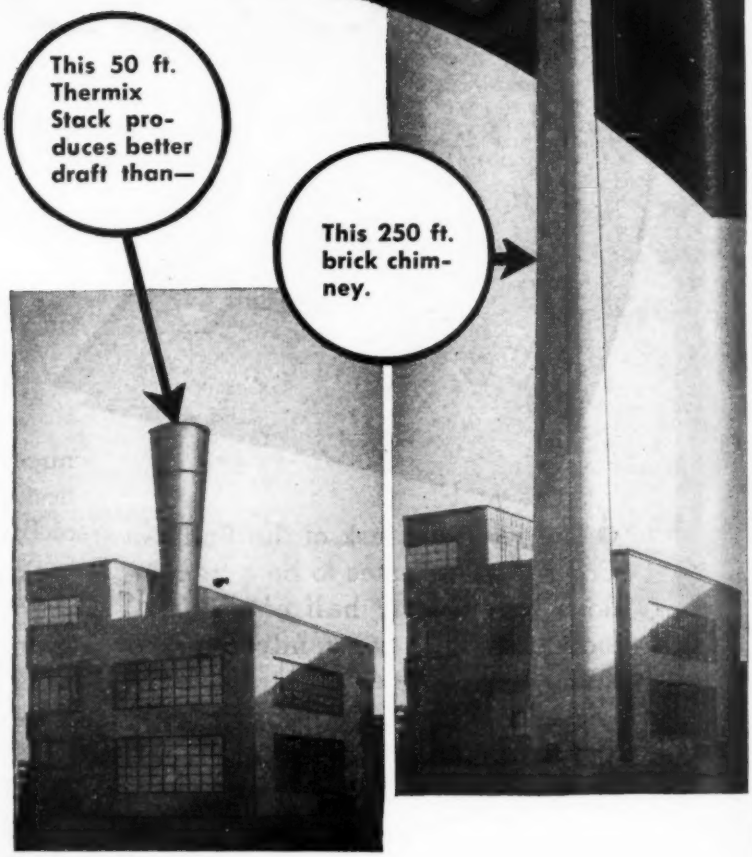
BROS Steam Generating EQUIPMENT

SAVE BY REDUCING THE SIZE OF YOUR CHIMNEY



Thermix Fan-Stacks are comparatively light-weight and can be installed at a level with the top of boiler, saving material from the ground to that point as well as at the top, and reducing the breeching to a minimum.

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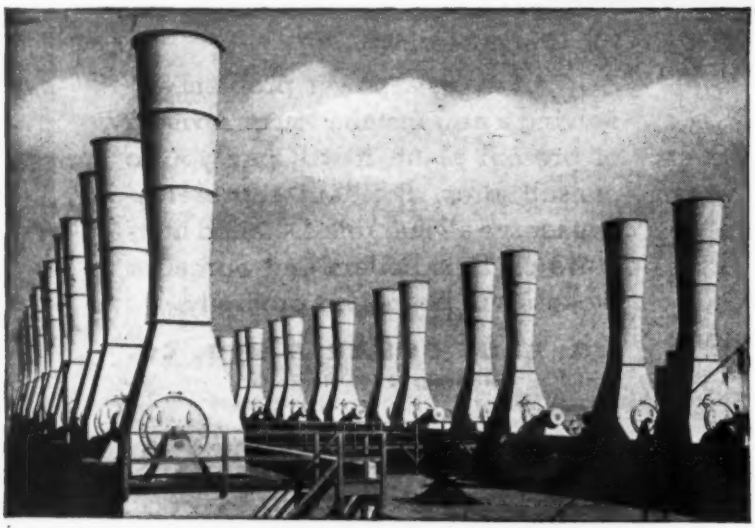
Another thing, Thermix Fan-Stacks save much steel, which is vitally important to the war effort.



Hundreds of power plants for central power stations, war plants for the Army and Navy and manufacturing plants of all types have been equipped with Thermix Fan-Stacks during the past 20 years.

Other advantages are explained in our Catalog No. 109. Write for a copy.

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CONTRACTS TO CLOSE BY *Remote Control*

EMPLOY JUST ONE NON-METALLIC MOVING PART TO OPEN OR CLOSE

The fully self-contained, self-operating Grove Fexflo Remote Control Valve is automatically self-compensating for abrasive wear resulting from the transmission of fluids containing sand or other small solid particles. It is designed for any fluid service such as handling oil, water, salt water, chemical solutions, gases and air. Its flexible expansible tube overcomes not only the problems of erosion but also that of corrosion and electrolytic action, commonly encountered in ordinary valves. The Grove Flexflo establishes a new low in valve maintenance. Adjustments or servicing are seldom if ever required. Just one non-metallic moving part operates to open and close the valve. The tube and core, after extended periods of constant and severe service, can be quickly replaced. No machining, grinding, lapping or other operations are necessary. Exhaustive "LIFE TESTS" disclose that after opening and closing more than 250,000 times, the Flexflo Valve shows no perceptible wear. Positive bubble-tight, air-tight shutoff at maximum working pressure—as well as smooth non-turbulent streamline flow is definitely assured at all times.

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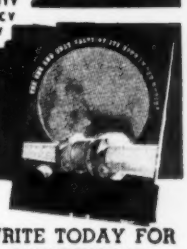

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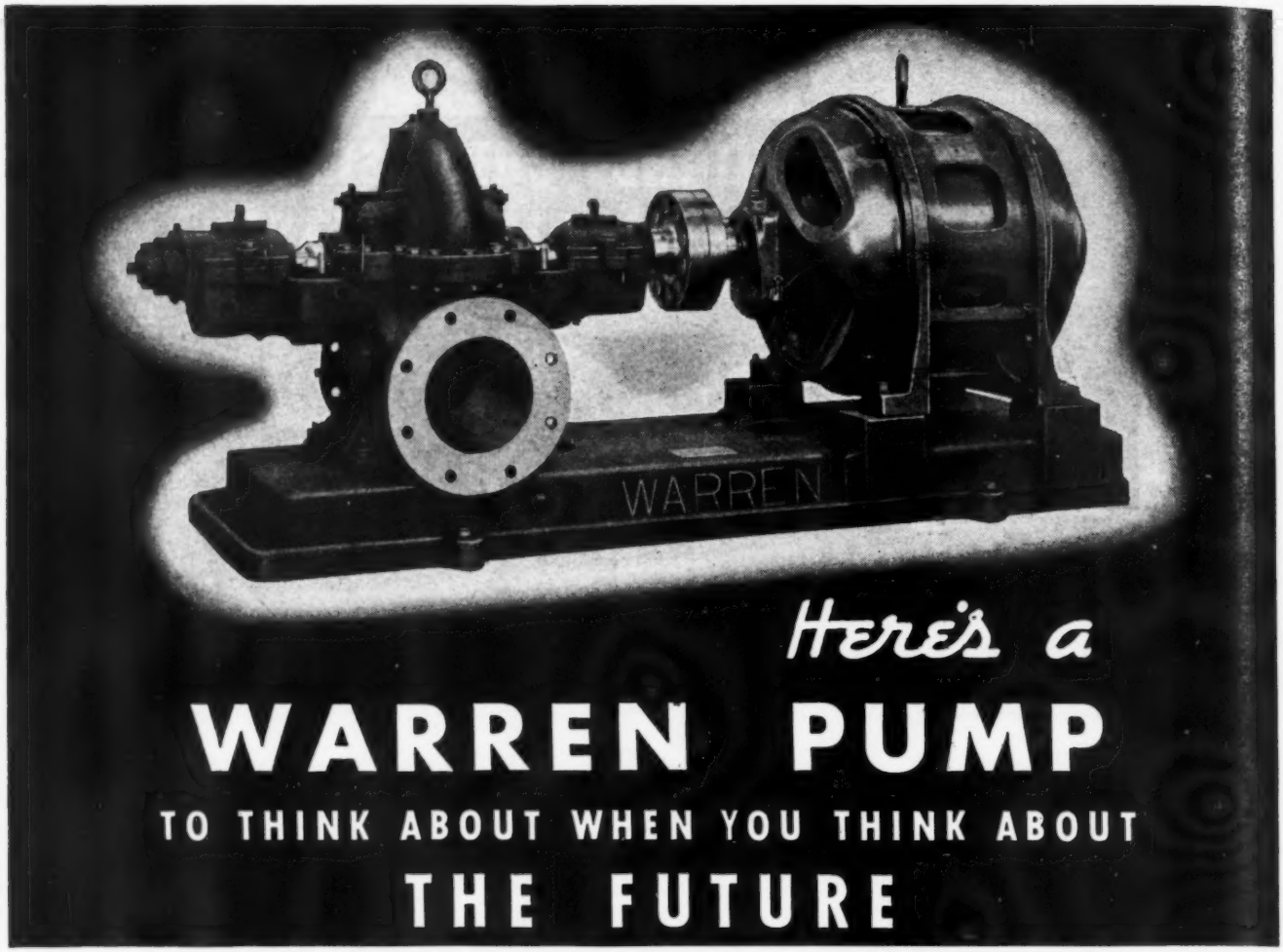

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Check these features:

CASING: Pump casing is of the double suction, volute type divided on the horizontal center-line. Suction and discharge nozzles are cast integral with lower half. Bearing brackets on smaller sizes are cast integral with lower half of pump casing. On larger sizes brackets are securely bolted and dowelled to the pump casing. Water passages are designed to produce smooth flow with gradual changes in velocity. By removing case cover and bearing caps, the entire rotating member may be removed for inspection or repair without disturbing pipe connections.

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BEARING THRUST: All pumps are fitted with a ball thrust bearing of the double row angular contact type, designed to take thrust in either direction.

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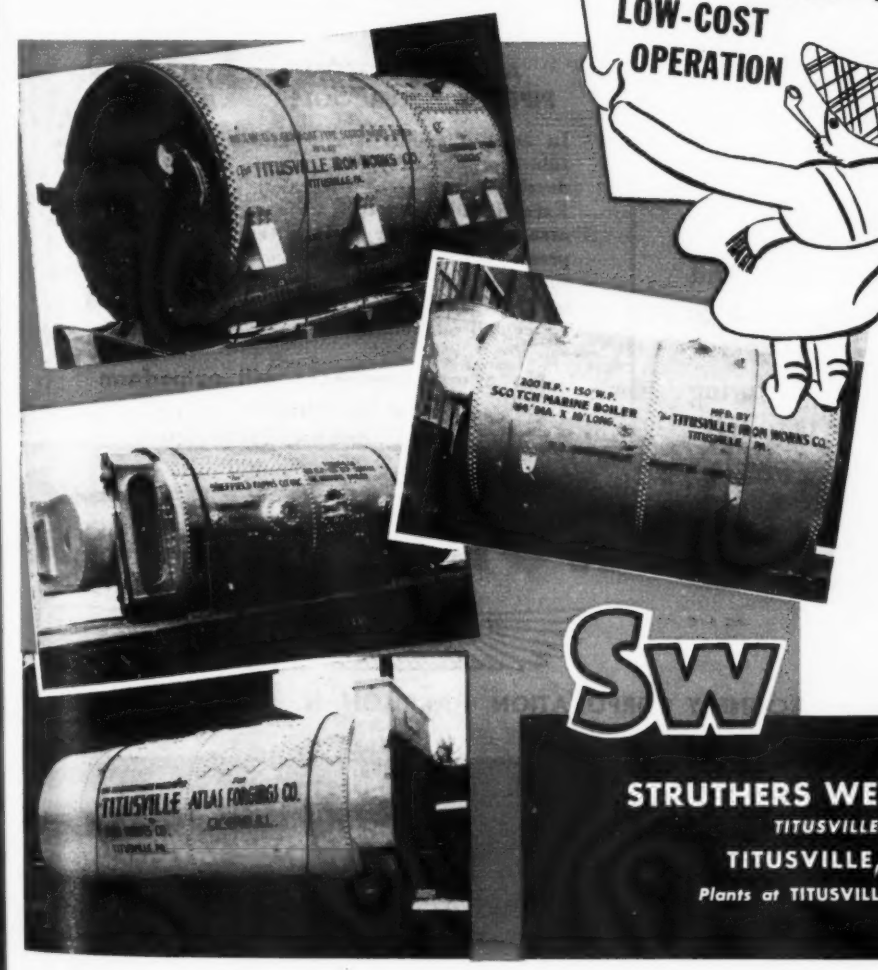

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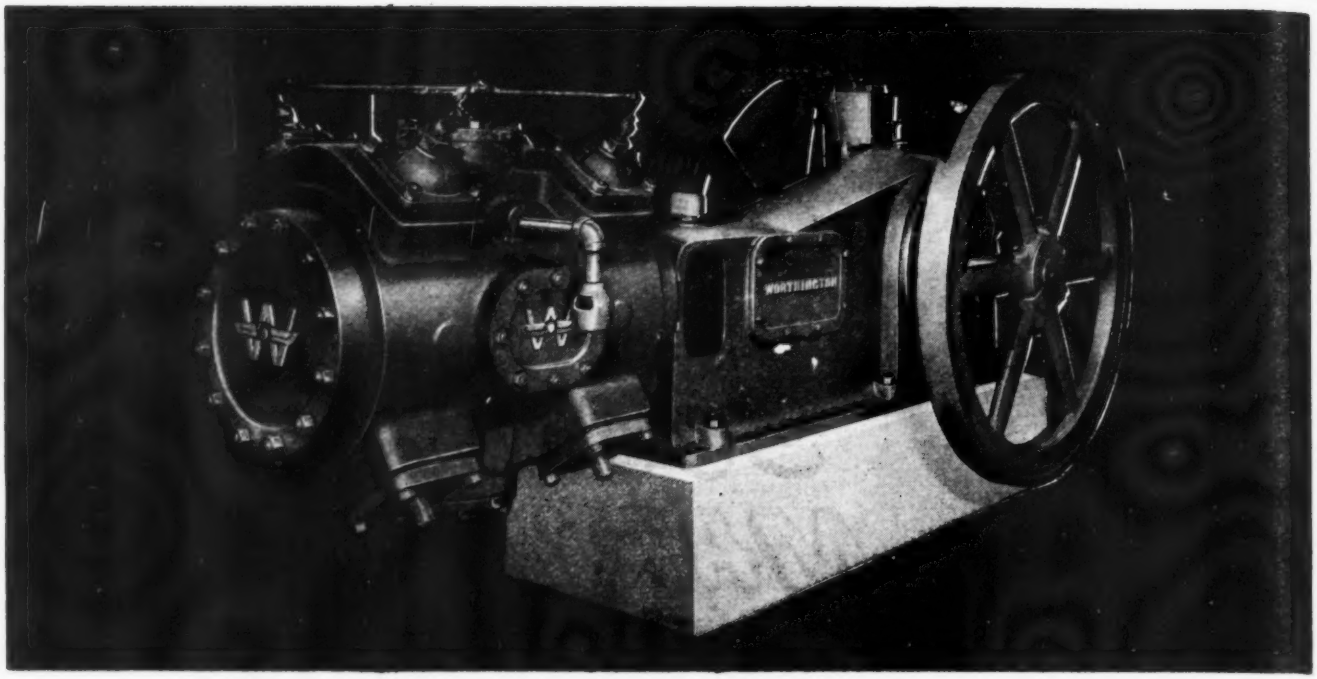

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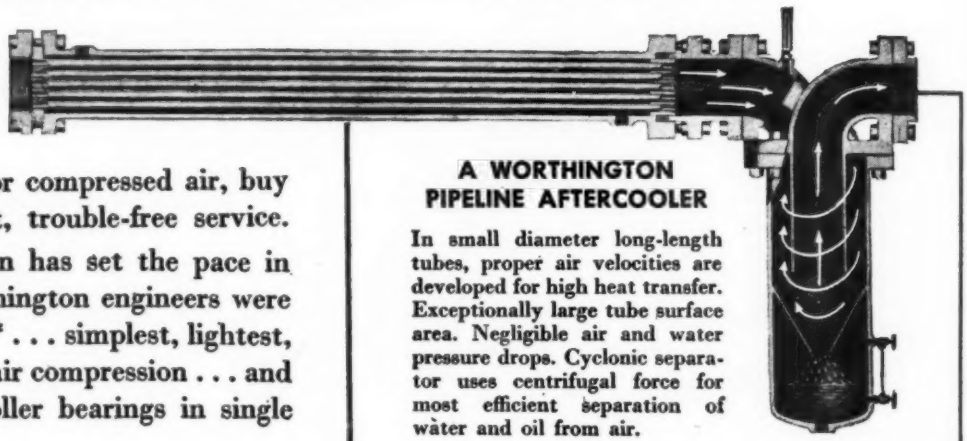

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Just address M. P. Catherwood, Commissioner of Commerce, Albany 1, New York, and your request will receive immediate attention.

NEW YORK STATE

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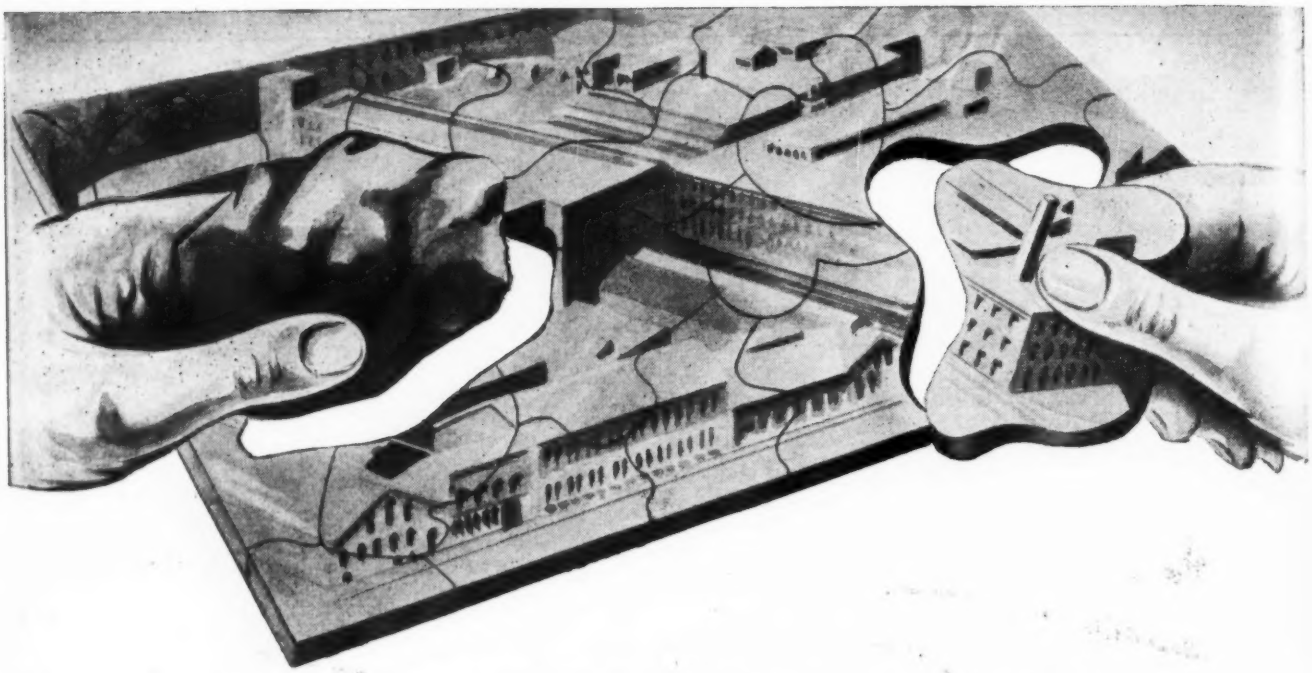

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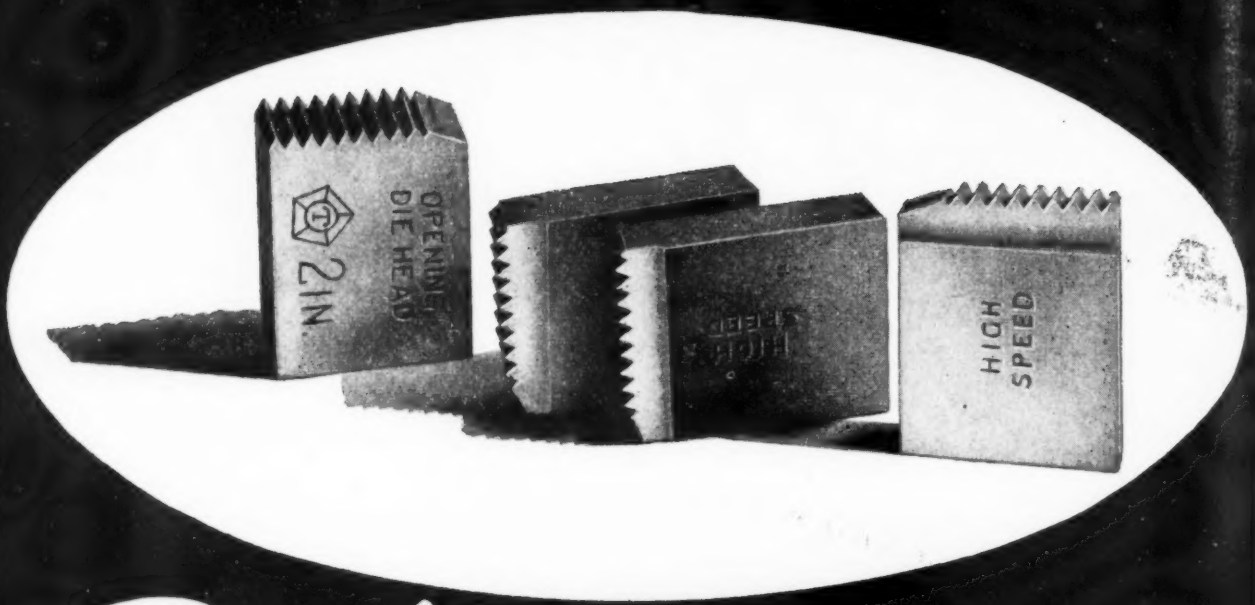

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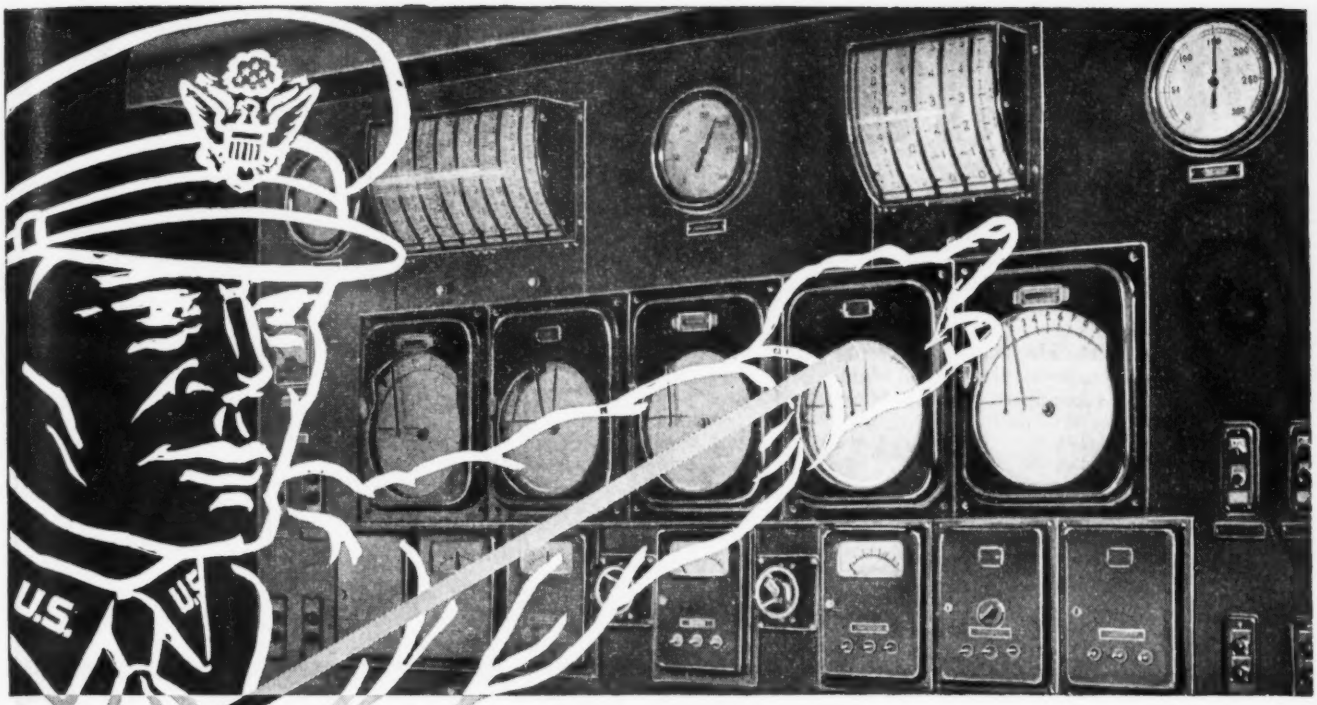
TO KEEP 'EM CUTTING 5 TO 100 TIMES LONGER!

● Your Toledo Dies and Cutters can be resharpened again and again—if you don't neglect them. This means—have your dies, cutters and reamers *ground* when dull—don't throw them away and don't use them until they chip.

If sharpened, instead of thrown away when dull, your Toledo Tools will produce 5 to 100 times as much work. This saves steel for the war effort—and saves money, too. If you have not the facilities to resharpen your Toledo dies, cutter knives and reamer heads, return them to us. Our charge will be moderate. The Toledo Pipe Threading Machine Co., Toledo, Ohio. New York Office, No. 2 Rector Street.

TOLEDO
PRECISION PIPE TOOLS



USE THIS WINNING STRATEGY ON YOUR BOILER PLANT

Fuel-Saving Starts With CONTROL

THOSE perpetual foes of combustion efficiency—Excess Air, Fuel waste, High Operating Cost—haven't a chance against the strategy of Hays Automatic Combustion Control.

There's no guessing here, nothing left to chance. Your Hays Control System assembles *all* the data concerning combustion, measures all variable elements, and *regulates* them—automatically. It does that job better than man-power can do it—never absent, never overworked, never an unwary instant: smooth, faultless, *tireless* efficiency 24 hours every day.

Hays Combustion Control's greater service today is in putting youthful efficiency back into wasteful steam plants—making them *better* plants, safer plants, lower cost plants.

Smart strategy?—it never misses. The Hays Combustion Control Catalog explains how you can use it. Full of helpful steam-power data. Write for it today.

THE MODERN SYSTEM *It's Electrical*

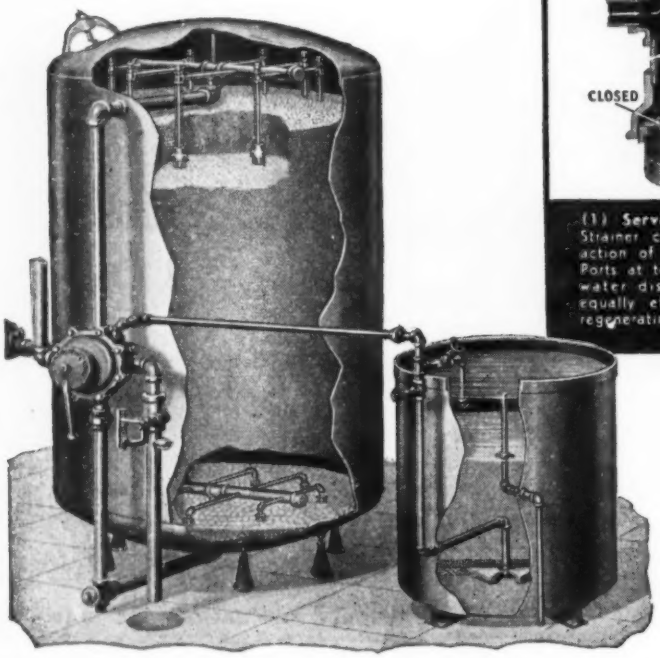
HAYS *Automatic* COMBUSTION CONTROL

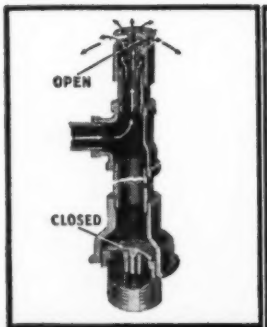
THE HAYS CORPORATION • MICHIGAN CITY, IND.

44% MORE CAPACITY!

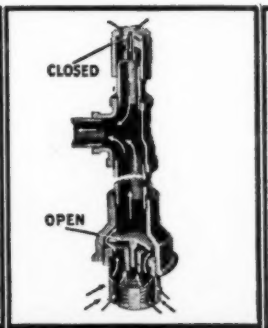
That's the remarkable record of the Improved Elgin "Double-Check" Water Softener

The improved "Double-Check" manifolds are shown in the cutaway view of the Elgin Softener below. Close-ups at right explain operation.





(1) **Service position.** Strainer closed off by action of lower check. Ports at top give even water distribution — equally effective when regenerating.



(2) **Backwashing.** Strainer now open. Greater part of wash water passes through it; balance through small ports in top. This flushes out foreign matter without zeolite loss.

(3) **Lower strainer nozzle.** Section through strainer shows shape of slots which prevent loss of zeolite when softening and gives free action when backwashing.

THE already well-established Elgin "Double Check" Water Softener has now been further improved to provide ever greater softening capacity and efficiency. Illustrated above is the improved "Double-Check" type manifold. It permits the use of a far deeper zeolite bed by preventing zeolite loss.

More zeolite naturally means more soft water output. The 44% increase in capacity headlined above is not the exceptional case, but is fully confirmed by a *long list of users* whose names are available to you.

Since the zeolite cannot escape, higher backwashing rates are possible with the "Double-Check" equipment. Better backwashing cleans the softener thoroughly and prevents packing and channelling. As a result, the brine reaches every grain of zeolite, giving better regeneration with less salt consumption.

If you are planning the installation of zeolite water softeners for power, process or general applications, don't overlook the added capacity and economy of this improved design.

THE "DOUBLE-CHECK" ALONE—

- **Delivers up to 44% more soft water**
- **Prevents loss of zeolite**
- **Cuts salt consumption**
- **Permits more thorough backwashing**

("Double-Check" manifolds can be installed in any make softener)

STEP UP THE CAPACITY OF YOUR PRESENT WATER SOFTENER!

— the "Double-Check" manifold and Elgin high-capacity zeolite will do it.

The "Double-Check" manifold arrangement can be quickly installed in place of the ordinary manifold system of any make water softener to provide the above features. Immediate delivery can be made on any type zeolite required for refill purposes. Let us show you how economically these Elgin modernization steps can give you that much-needed extra capacity.

OTHER ELGIN PRODUCTS

- ▶ Boiler Water Conditioning Systems
- ▶ Deconcentrators
- ▶ Continuous Blowdown Systems
- ▶ Filters and Purifiers
- ▶ Oil Removal Filters
- ▶ Aerators
- ▶ Chemical Feeders
- ▶ Water Treating Chemicals
- ▶ Water Testing Equipment

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ELGIN SOFTENER CORPORATION
130 North Grove Avenue, Elgin, Illinois

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DAMAGED CASTINGS
WHICH ARE CRACKED AND BROKEN?

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Every job is guaranteed as follows (subject to normal operating conditions): Against leakage; extension of the crack; breakage of the locks; breakage of the parent metals with the repaired area, and against movement. Positive safety factor guaranteed. *Castings repaired on location or at any of the following agencies:*

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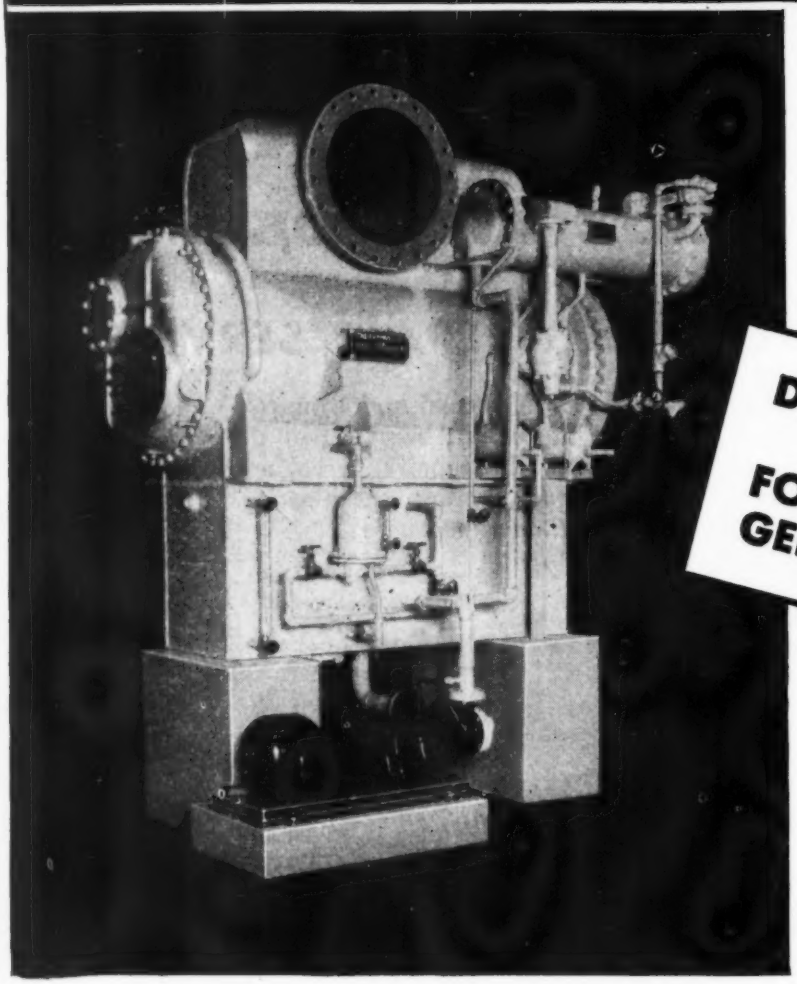
Send for application. **METALOCK, Box 314, Columbus, Ohio**

1,000 kw package type surface condenser



DESIGNED AND BUILT BY LUMMUS FOR INTERNATIONAL GENERAL ELECTRIC CO.

Shipped complete . . . ready for installation on a mobile power train . . . this 1,000 kw package type surface condenser is one of twenty-three designed and built by Lummus for the International General Electric Company.

Among the interesting features of design and construction are . . . tube sheets welded to the shell of the condenser, eliminating two packed joints (sources of possible air leakage) . . . complete deaeration of condensate in the hot well through the introduction of exhaust steam in the deaerating system . . . air ejector set, designed and built by Lummus is an integral part of the package unit.

Lummus designs and builds a complete line of surface condensers and other heat exchange equipment for stationary, marine, and refinery applications. Write for complete data.

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- Surface Condensers
- Steam Jet Air Ejectors
- Bleeder Heaters
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- Fuel Oil Heaters
- Lubricating Oil Coolers

THE LUMMUS COMPANY • 420 LEXINGTON AVE., NEW YORK 17, N. Y.

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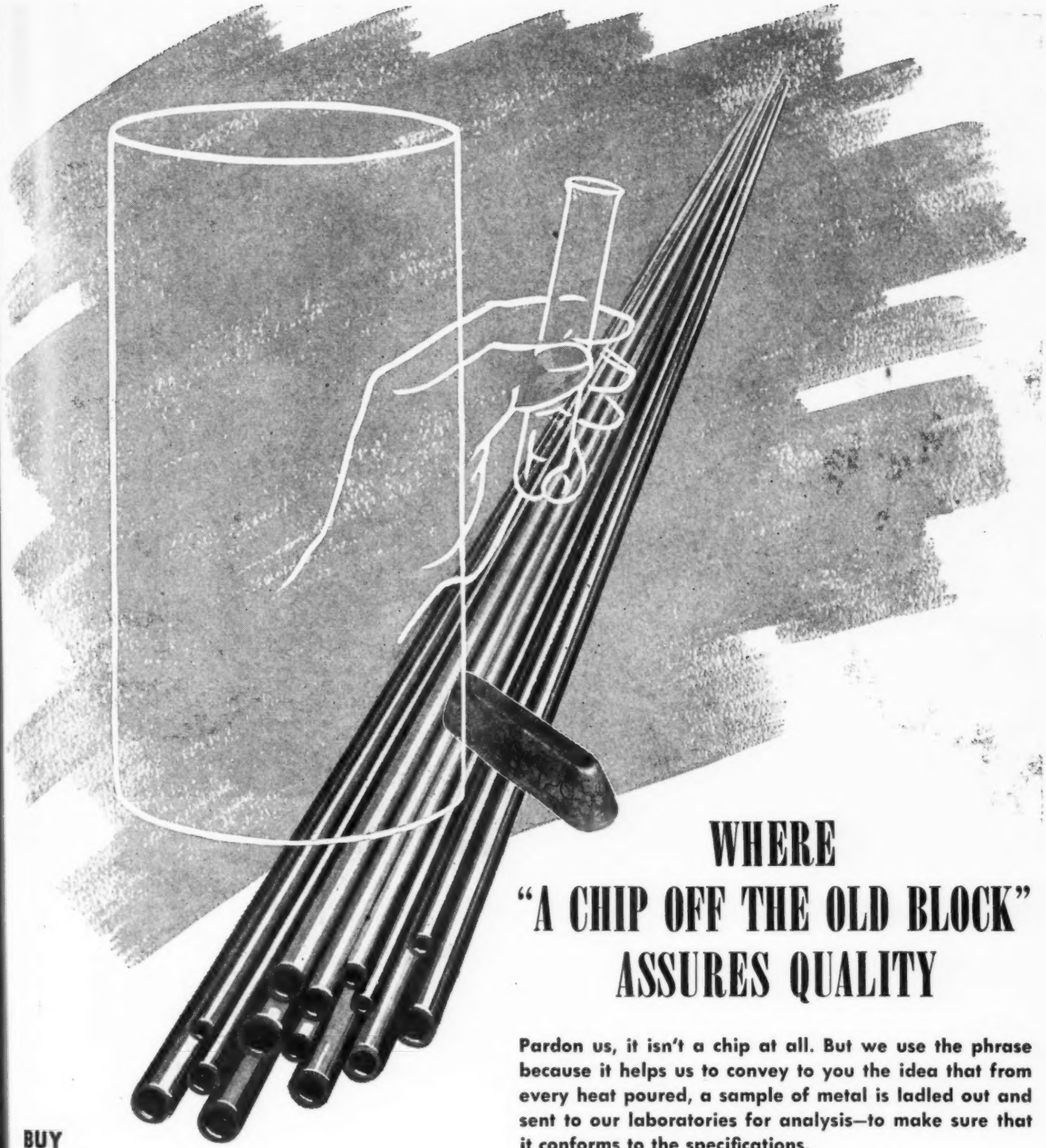

WHERE "A CHIP OFF THE OLD BLOCK" ASSURES QUALITY

Pardon us, it isn't a chip at all. But we use the phrase because it helps us to convey to you the idea that from every heat poured, a sample of metal is ladled out and sent to our laboratories for analysis—to make sure that it conforms to the specifications.

This procedure is one of the first in a succession of steps taken in our endeavor to control quality "from ore to finished product."

Another important step (also taken *before* the base size tube is made, to assure your getting tube that will meet the highest standard) is the scalping of each block, a process which removes the "skin" to permit a careful inspection of the block and make certain that no imperfections find their way into the extruder and finally into the finished tube.

You are always sure of uniform quality in non-ferrous tubing when you specify Wolverine.

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TUBE DIVISION

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HOW AIRFIELDS GROW ON MUCK, ON SAND, ON TUNDRA

ON world-wide battle fronts America's planes are taking off on missions against the enemy—taking off from desert sand, jungle muck, or Aleutian tundra.

In a matter of days, bulldozers shove aside the muck or level the sand. And giant cranes lay steel landing mats that are bolted into a landing strip.

Look at the engines in these bulldozers and cranes. You'll find familiar friends—the same friends that power tanks and trucks, landing barges and patrol vessels, tractors and auxiliaries—General Motors Diesels.

And in these rigorous jobs of war, a promise is being written—a promise of plentiful, dependable, easily maintained, low-cost power for America's needs in the peacetime days ahead.

Tomorrow

Reconstruction and new construction are going to need plenty of this hard-hitting, easy-on-the-fuel power. With normal refinement and development speeded up by war, with production expanded, GM Diesels will be ready to serve in more fields and in more ways than ever.

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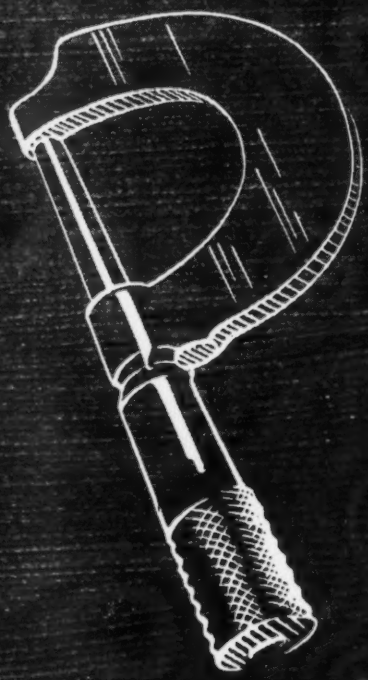
How a film .0025″ thick *adds years of life* TO BOILERS



APEXIOR...a technical protective coating for mechanical equipment

An impenetrable barrier against water, which will add years of life to new boilers and provide added service from old boilers . . . is available to you in APEXIOR NUMBER 1. Two coats of this high temperature water and steam resistant paint, measuring .0025″ in thickness, will resist wear and corrosion over a long period of time. And it is renewable by applying a single coat when needed, possibly once in two to three years.

Under average conditions, and when boiler deposits, if any, can be washed down or removed by means of a light bristle or wire brush, the coating may last for several years. A single make-up maintenance coat is generally necessary after mechanical cleaning with a sharp cutting head.

APEXIOR is brush-applied by hand or power-coater. It is easily renewed.

Painting boiler metal with APEXIOR is recommended by boiler insurance companies. And many manufacturers of turbines coat shafts, rotor bodies, and frequently interiors of casings with APEXIOR before shipping to customers.

Hundreds of operators have used APEXIOR NUMBER 1 for years as an economical means of boiler maintenance. Recently, many more have adopted APEXIOR as a guarantee of longer life for metal that cannot be replaced. They discovered that boilers nearing the end of their life, if able to pass inspection and a hydrostatic test, could be APEXIORIZED for years of extra service.

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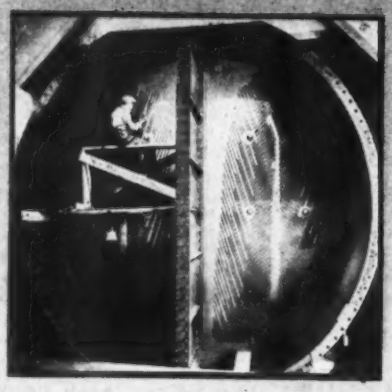
Retubing and Repacking are *EASY* with

JOHN CRANE CONDENSER PACKING



- Quickly and easily installed — with simple, inexpensive tools.
- Seals tubes quickly and positively; no adjustment required; high vacuum maintained.
- Eliminates ferrules; no necking of tubes.
- Belled inlet ends increase condenser efficiency.

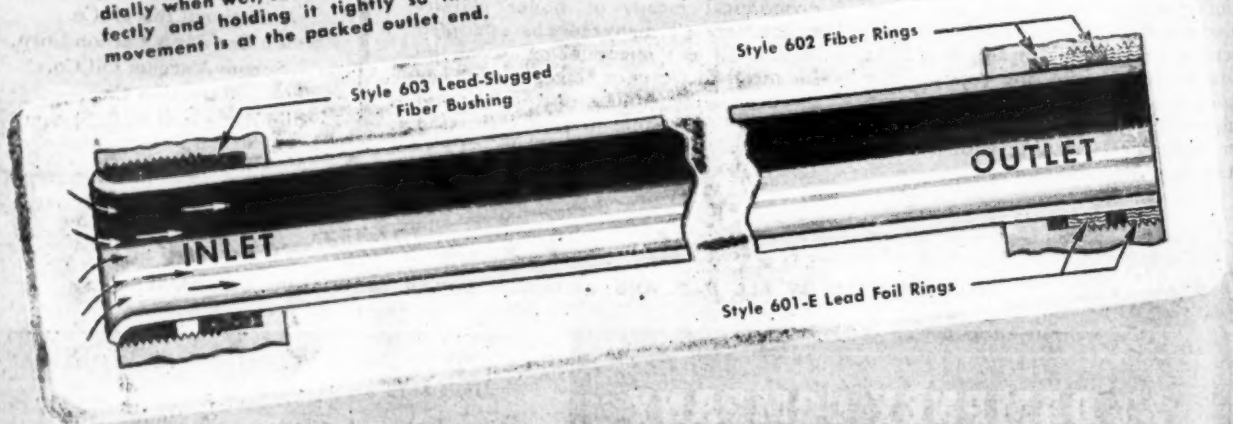
To shorten down-time and save valuable man-hours, use the John Crane Packing Method—the easiest, quickest, most economical method of all.

Inlet End

The Inlet End of the tube may already be rolled into the tube sheet. If not, the same effect is obtained by using a Style 603 Lead-Slugged Fiber Bushing driven into the stuffing box as shown below, with the tube end belled to make a "Venturi" entrance. The ring fits closely and swells radially when wet, sealing the tube end perfectly and holding it tightly so that all movement is at the packed outlet end.

Outlet End

The Outlet End of the tube is packed with a set of metallic and fiber rings as shown below. The soft lead foil rings flow into and fill the threads, while the fiber rings fit closely and swell radially when wet. The tube is free to expand and contract at the outlet end, yet a tight seal is maintained.



Ask your friends who have used John Crane Condenser Tube Packing—they will tell you it costs less in the long run, is easier to install and improves over-all condenser efficiency. Then write for our Engineering Recommendations.

Buy More War Bonds

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50,000 KVA INTERRUPTING CAPACITY

MOTOR STARTERS BY EC&M

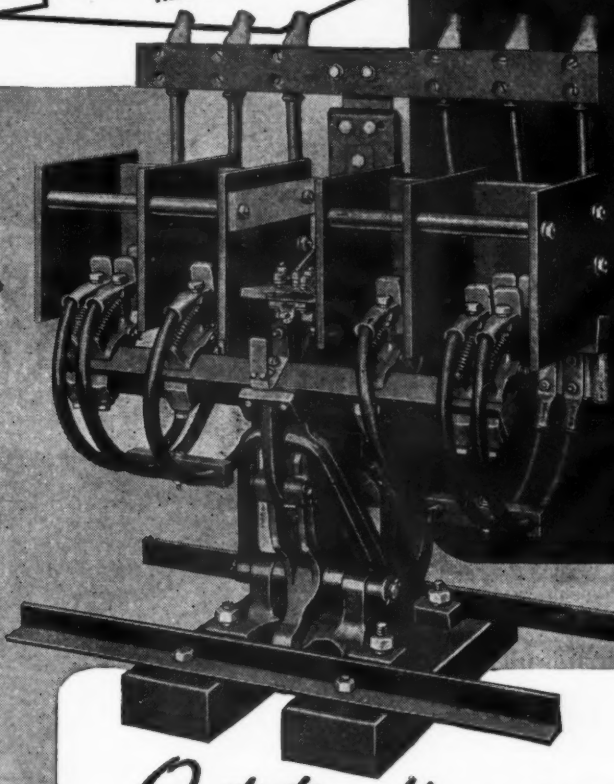
Also Available in 25,000 KVA and Moderate Interrupting Capacity

HEAVY DUTY MAGNETIC CONTACTOR — 1500 H.P. Max. 2300 Volt Contactor — 50,000 KVA Interrupting Capacity

THESE heavy duty starters, for full voltage starting of **2300 volt** and **4600 volt motors,** are of magnetic contactor design—suitable for both severe, repetitive starting and inching applications.

Where equipment with high interrupting capacity is required, 25,000 and 50,000 KVA starters are recommended. Also available are moderate interrupting capacity starters for 2300 volts. Reversing starters have two moderate capacity contactors, mechanically and electrically interlocked and mounted in one tank.

STANDARD STARTER
with oil-immersed contactor tank in front and overload relays accessible through door above.



COMBINATION STARTER
having self-contained disconnect switches—contactor-tank at rear.

Outstanding FEATURES OF DESIGN!

1. Heavy-duty, magnetic contactors specifically designed for high voltage service.
2. Contacts are large and provide over 2" opening at the off position.
3. Self-contained potential transformer supplies 220 volts for push-button operation.
4. Adjustable type overload relays, magnetically reset from push-button—or hand-set if desired.
5. Convenient terminals and large conduit connection box make installation easier, faster.

Send for new Bulletin 1062-C for *full voltage starting* of 2300 and 4600 volt motors. It also describes Type VIII Enclosed Starters for Class 1, Group D Hazardous Locations.

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THE ELECTRIC CONTROLLER & MFG. CO.

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PROTECTION FOR OPEN AND ENCLOSED GEARS

The periodical check-up with a feeler gauge tells the story.

With LUBRIPLATE Lubricants, the teeth of gears are absolutely separated by a load carrying film. Metal cannot touch metal. LUBRIPLATE lowers operating temperatures and seals the gears against rust and corrosion. Yet, in spite of its protective qualities, LUBRIPLATE does not cause drag. Even the most delicate, high speed gears operate better with it. LUBRIPLATE reduces friction to a minimum.

Yes, open and enclosed gears as well as chains, slides, sleeve and anti-friction bearings and all contacting parts last longer and require less power to drive them when lubricated with LUBRIPLATE. Let us send you a copy of "The LUBRIPLATE Film" that tells the whole story. It is written especially for your industry.

Rx FOR YOUR MACHINERY

No. 3—Ideal for general oil type lubrication. Ring oiled bearings, wick feeds, sight feeds and bottle oilers.

No. 6—Because of its high film strength and long life reflects outstanding performance in most types of enclosed gears (speed reducers).

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No. 130-AA—Known nationwide as the superior lubricant for open gears, heavy duty bearings, wire rope, etc.

BALL BEARING—This is the LUBRIPLATE lubricant that has achieved wide acclaim for use in the general run of ball and roller bearings operating at speeds to 5000 RPM and temperatures up to 300 degrees F.

LUBRIPLATE DIVISION

FISKE BROTHERS REFINING COMPANY

NEWARK, N. J. **SINCE 1870** TOLEDO, O.

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CHASE ANTIMONIAL ADMIRALTY*

Millions of pounds of Antimonial Admiralty tubes in service for periods up to eight years . . . and not a single failure has been reported from dezincification. This is the outstanding performance record of Chase Antimonial Admiralty. Yet, while the presence of antimony in this alloy reduces considerably the yearly costs of condenser tubes — by increasing resistance to dezincification — there is no increase in the initial cost of the tubes.

REMEMBER these three points about Chase Antimonial Admiralty. It is (1) extraordinarily resistant to dezincification; (2) virtually immune to stress-free intercrystalline corrosion; (3) no more expensive than plain Admiralty.

For full information on Antimonial Admiralty, just phone the nearest Chase Sales Service Office.

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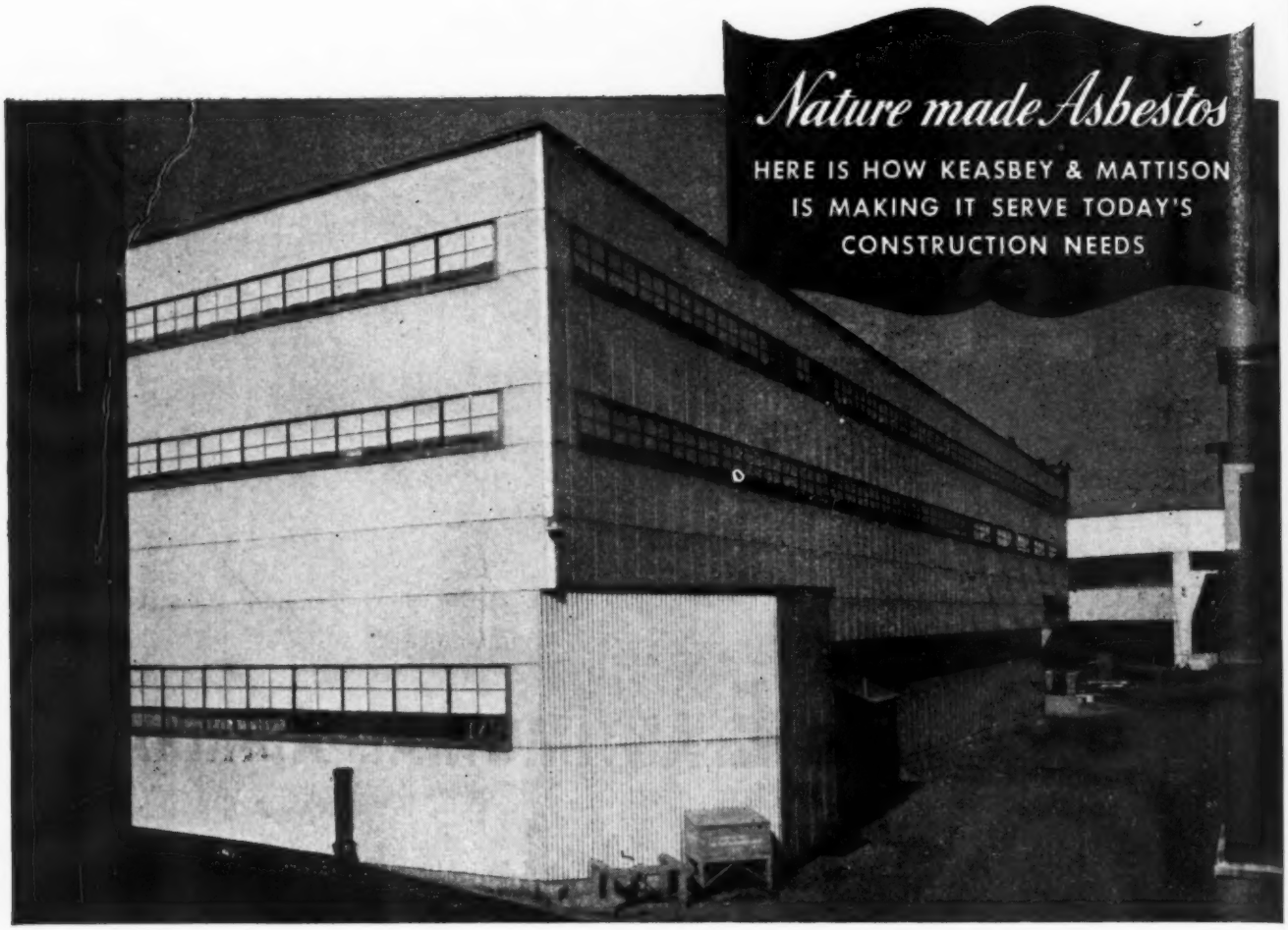
This is the Chase Network — handiest way to buy brass



"Century" ASBESTOS CORRUGATED

BUILDS FOR PERMANENCE

In vital buildings like these—belonging to a large shipbuilding and iron works establishment—K&M "Century" Asbestos Corrugated has established its worth. It is a material that can be depended on for a century of service, strength, freedom from fire hazard.

"Century" Asbestos Corrugated is a tough material . . . produced by applying tremendous hydraulic pressure to a combination of asbestos fibre and portland cement. It has an attractive, cleancut appearance that never requires protective painting. It is amazingly adaptable and economical because it is maintenance free . . . the ideal siding and roofing material for buildings with an eye toward *permanence.*

K&M "Century" Asbestos Corrugated has ably filled all essential wartime demands made of it. Millions upon millions of feet are now serving vital purposes. Now this time-saving, money-saving material is again available for general use . . . for plant renovation and construction.

Meanwhile forward-looking research continues at K&M. New Asbestos products and processes are constantly being uncovered . . . and are being groomed to serve America when peace returns again.

Our Ambler plants proudly fly the Army-Navy "E" flag with its star—an honor awarded K&M employees "for continued outstanding production of war materials."

KEASBEY & MATTISON

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PUMP AND MOTOR ARE JUST LIKE THAT!*

. . . perfect balance prevents shaft distortion . . . saves bearings

* Pump and motor are a single simple, balanced unit in the Worthington MONOBLOC *centrifugal* pump — so operation is quiet, service is efficient, life is longer.

Alignment is perfect and permanent . . . no separate distance piece is required between pump and motor. And a base plate is unnecessary even on the larger sizes—saving floor space and installation cost.

Worthington is the first manufacturer to build a complete line of electric-driven *centrifugal* pumps of the Monobloc design that are truly balanced units — planned and mated *on the drawing board.*

The DE type for heavier general service includes pumps at capacities to 1600 G.P.M. and heads to 300 ft. — mated to the precise H. P. and R. P. M. for most efficient operation.

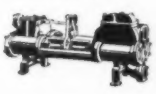
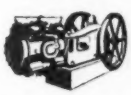
For details write for bulletin . . . using the coupon at the lower right.

180 pages of vital information in this easy-to-use catalog

It will pay you to have at your finger tips all the technical information about centrifugal, power, rotary and steam pumps, air compressors and liquid meters contained in this conveniently tabbed catalog. Check coupon.

WORTHINGTON PUMP AND MACHINERY CORPORATION, HARRISON, N. J.

MONOBLOC Pump and Motor a Simple Balanced Unit

Centrifugal Pumps	Rotary Pumps	Steam & Power Pumps	Vertical & Horizontal Compressors	Liquid Meters	Variable Speed Drives	Multi-V-Drives
						

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Worthington Pump and Machinery Corporation
Harrison, N. J.

Please send me complete Standard Industrial Products Catalog, including information on Monobloc *Centrifugal* Pumps.

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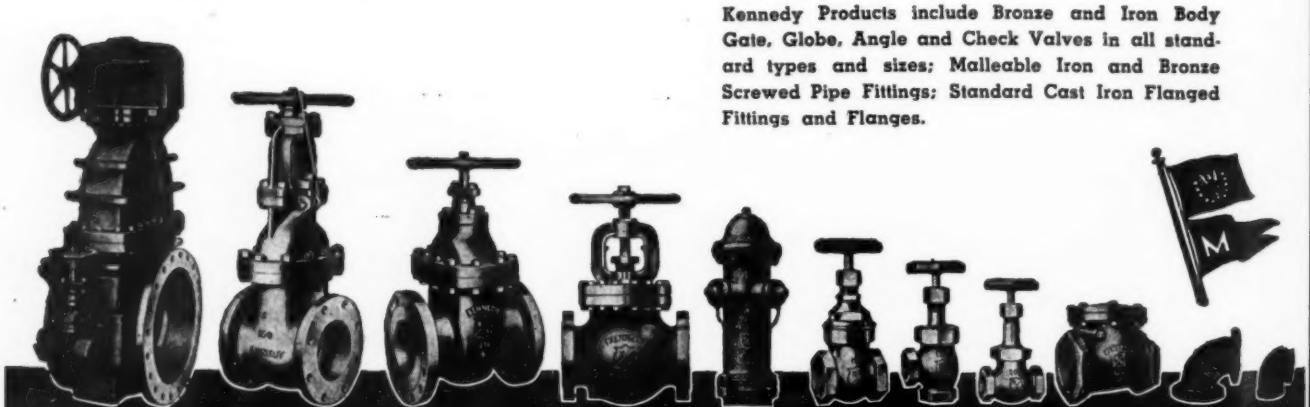
FOR DEPENDABLE VALVE SERVICE

Two generations of engineers who have used Kennedy Valves know that they are thoroughly reliable in every respect. Every Kennedy Valve can be depended upon to close tight, open easily, and give lastingly good service with minimum attention and maintenance expense. You are safe when you standardize on Kennedy. 240-page catalog sent on request.

THE KENNEDY VALVE MFG. CO.
Elmira, New York

Fig. 89—Kennedy 150-lb. Bronze Globe Valve With Renewable Composition Disc and Union Bonnet.

Kennedy Products include Bronze and Iron Body Gate, Globe, Angle and Check Valves in all standard types and sizes; Malleable Iron and Bronze Screwed Pipe Fittings; Standard Cast Iron Flanged Fittings and Flanges.



KENNEDY *valves . . . pipe fittings . . . fire hydrants*

CODE-QUALIFIED FLORI WELDERS ASSURE TROUBLE-FREE PIPING JOBS

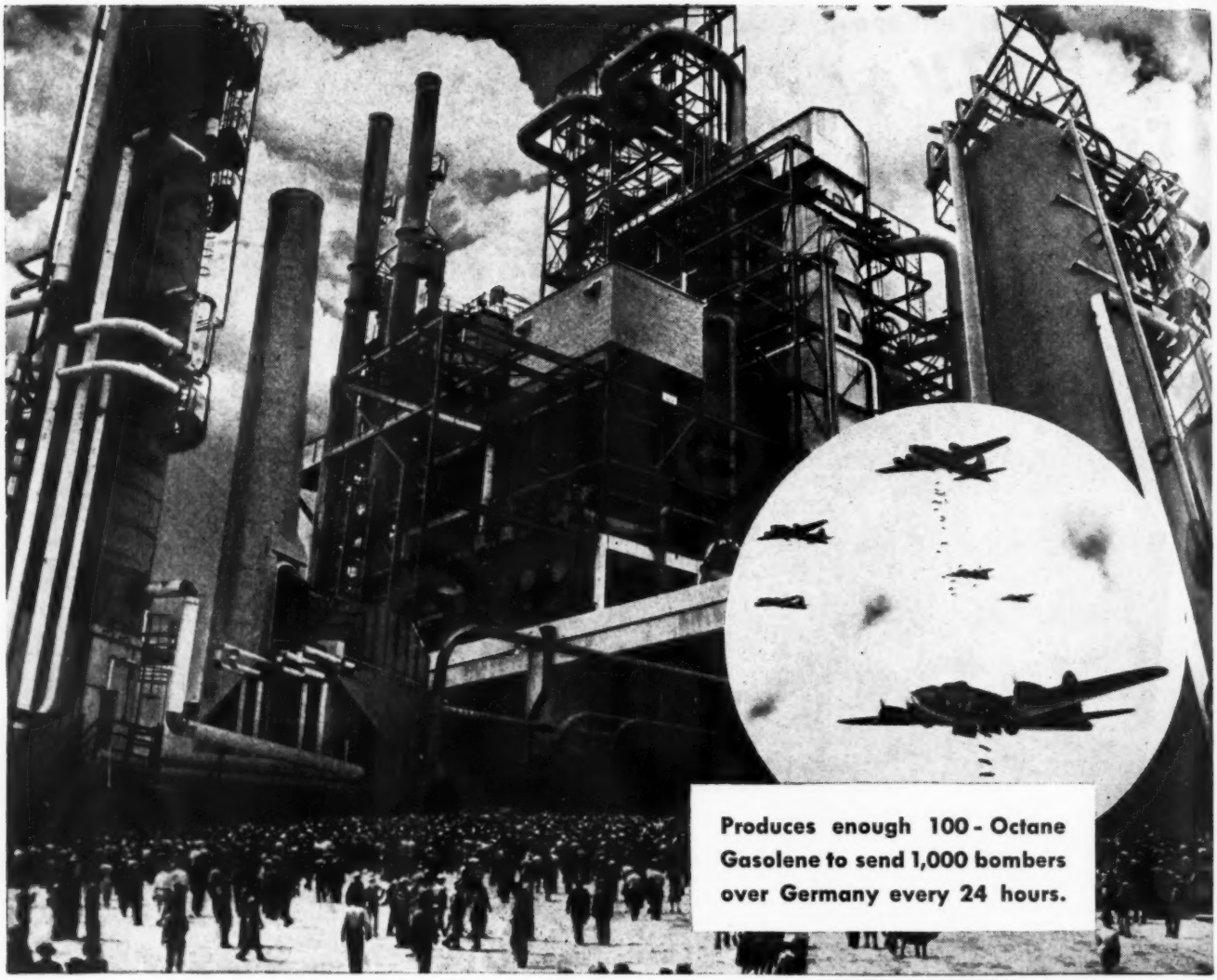
A piece of piping is no better than its welding seams. Flori welding procedures are accepted by Hartford Steam Boiler Inspection and Insurance Company, and performed by code-qualified-welders for metallic-arc-welding in accordance with ASME Power Boiler Code. Each of them is a master in the art of pressure welding and qualifies for high skill and expert workmanship.

This means to you: Flori-fabricated Piping is accurately welded—flawless, made to withstand strain and pressure. Ask our customers.

IF IT'S PIPING, CONTACT FLORI

FLORI PIPING

THE FLORI PIPE COMPANY • ST. LOUIS—CHICAGO



CITIES SERVICE

dedicates one of the world's largest 100-Octane and Butadiene Plants

WITH THIS giant plant at Lake Charles, Louisiana, Cities Service, in cooperation with the Government, takes a tremendous stride toward meeting two most vital war needs.

Sired by the necessity of War, the plant means more power to the armed forces, for it turns out great quantities of high-octane aviation gasolene and ingredients for synthetic rubber.

Created from the ground up, it includes the very latest discoveries and inventions; and it is wholly dedicated to bringing the War to an earlier close. This great accomplishment is an outstanding example of what can be achieved by the winning team of Government and Industry . . . working together, shoulder to shoulder, in the battle for Freedom and Peace.

GASOLENE POWERS THE ATTACK—*Don't waste a drop!*

✓CHECK LIST OF OUTSTANDING FACTS . . .

1. The Refinery produces enough 100-Octane Gasolene to send 1,000 bombers over Germany every 24 hours.
2. Ten per cent of the Nation's normal rubber demands will be supplied by the Government-owned Butadiene Plant, operated by Cities Service, and the Government-owned rubber plant, operated by Firestone.
3. The Refinery alone covers 600 acres.
4. Powered by enough electricity to light a city of 250,000.
5. 275,000 gallons of water per minute are pumped into the refinery.
6. 25,000,000 man-hours went into its construction.

CITIES SERVICE OILS — ONCE-ALWAYS

FREE: Handsomely illustrated booklet about one of the War's biggest industrial achievements. Write Cities Service, Sixty Wall Tower, New York 5, N. Y.

The brute force of line pressures up to 1500 pounds is harnessed with velvet smoothness by KEROTEST Valves. Easy action, positive closing, long life with minimum wear are Kerotest features . : : at work today for war—ready to serve you after Victory.

KEROTEST MANUFACTURING CO.
PITTSBURGH, PENNA.

When the Insulation Job is BIG...

When It Must Be Completed ON SCHEDULE

...You can rely on Carey SERVICE!

INSULATING many of the nation's largest wartime chemical, petroleum, and power projects—jobs such as Charlestown, Kobuta, Childersburg, Rosemont — CAREY engineers and erection crews have set remarkable records for speed and efficiency.

This nationwide organization, backed by years of practical experience, has the expert "know how" that assures better heat-insulation jobs, completed on schedule.

And just as the CAREY organization is your guarantee of getting insulation work done right and on time, super-efficient CAREY Heat Insulations are your best assurance of maximum performance and durability, utmost conservation of fuel, higher kilowatt output at lower cost.

For dependable Heat Insulation, efficient workmanship, and jobs completed "per schedule"—look to CAREY! Write for full details on Carey Heat Insulations. Address Dept. 16.

THE PHILIP CAREY MFG. COMPANY, Lockland, Cincinnati, Ohio

Dependable Products Since 1873

There's a Carey Heat Insulation for Every Need!

Careycel Insulation. For temperatures to 300°F.	85% Magnesia For High and Medium Pressure. Temperatures to 550°F.	Combination Hi-Temp—85% Magnesia Temperatures to 1200°F.	Hi-Temp Blocks For Furnaces, Ovens, Kilns, etc. Temperatures to 2500°F.

NO MATTER what speeds are used to drive your machines, that speed varies to such a degree between heavy starting loads and normal running loads, that machine output is considerably reduced.

The American Econ-o-matic Drive (short-center flat-belt or V-belt type) cures that headache automatically. In fact it provides the *only fully automatic* belt tension control. Because it utilizes the torque reaction of the motor, the load governs the tension. Heavy loads increase the belt tension—light loads release it.

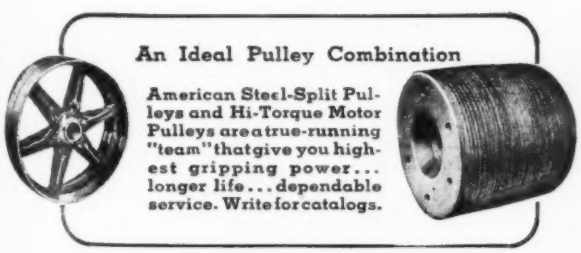
As a result, there is no necessity for frequent "time outs" for manual adjustment. Up to 75% of maintenance man-hours are eliminated. And, automatic tension control prevents belt slip and resultant loss of rpm. Machine output may be increased as much as 15%. The smooth, cushioned starting of the Econ-o-matic Drive lengthens the life of motor, bearings and belts. Write for the Econ-o-matic Handbook which gives complete drive data, solves drive maintenance problems and assists in the selection of the proper drive to meet your need.

Textile Mill Saves $2187.50 on Cylinders and Bearings Alone in 30 Months

A starting load of 18 hp. as against a normal running load of 6 hp. was the cause of frequent failures of bearings, twisted spinning frame cylinders and damaged head-end gears. American Econ-o-matic Drives were installed on 70 frames saving $12.50 per year per machine while the maintenance consisted of only one belt take-up in the first four months.

The American Pulley Company

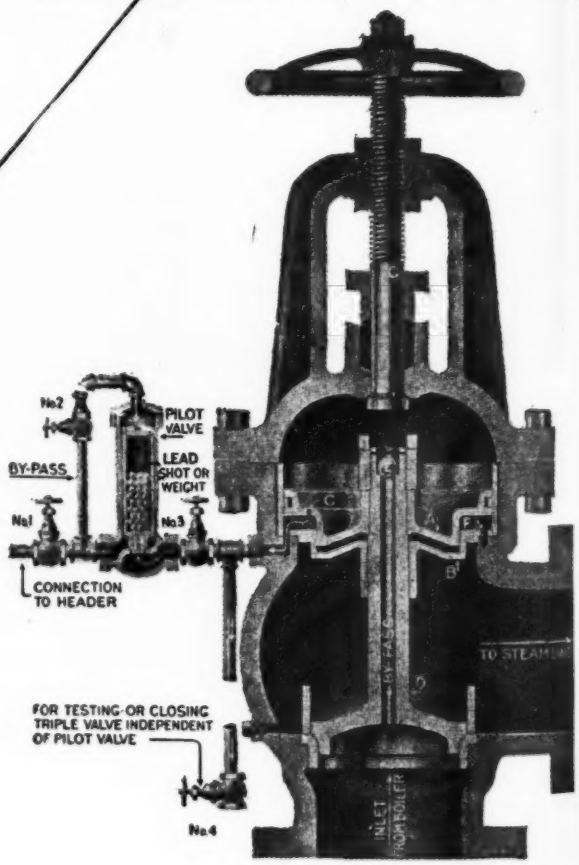
4224 WISSAHICKON AVE., PHILADELPHIA 29, PA.


An Ideal Pulley Combination
American Steel-Split Pulleys and Hi-Torque Motor Pulleys are a true-running "team" that give you highest gripping power... longer life... dependable service. Write for catalogs.

Here is Independent Automatic Protection against Line Rupture and Explosions . . . It's the

GOLDEN-ANDERSON

TRIPLE-ACTING NON-RETURN VALVE



• Capacity . . . ability to hold adjusted pressures . . . safe, positive action . . . automatic life and property protection — all in one unit! That, briefly, is the GOLDEN-ANDERSON Triple-Acting Non-Return Valve — a special service unit designed to prevent damage due to line ruptures or explosions by cutting in a boiler whenever its pressure equals line-header pressure, and isolating a boiler whenever its pressure is lower than line-header pressure. In addition, this valve will prevent steam flow from the boiler if there is a sudden drop of line-header pressure below boiler pressure.

Assure absolute safety for your operations . . . equip *your* boiler room with this valve now! Prevent service troubles and "down time".

★

Complete, specific application and operation data on GOLDEN-ANDERSON Specialty Valves is contained in our latest catalog. Write for your copy today. No obligation.

GOLDEN-ANDERSON VALVE SPECIALTY CO.

FULTON BLDG. • PITTSBURGH, PA.

Manufacturers of Special Valves for Special Services

THE FIRST LABORATORY TEST FOR CONTROLLED QUALITY

The Macro-Etch test reveals uniformity of quality and steel composition. Unprecedented facilities were developed and built by Ladish to insure the maintenance of controlled quality. This test is given to samples of each heat of steel received at the plant.

The Ladish *heat code,* permanently stamped on every *Ladish green painted forged steel flange,* identifies the specific heat of steel from which the flange was forged. Complete certified reports of chemical, physical and spectrographic tests, of which the Macro-Etch test is one, attesting the quality of the steel can be obtained from Ladish Drop Forge Co.

Steel identity stamped on each flange was pioneered by Ladish and has been a Ladish standard for many years

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ARMY E NAVY

FITTINGS DIVISION

LADISH DROP FORGE CO.

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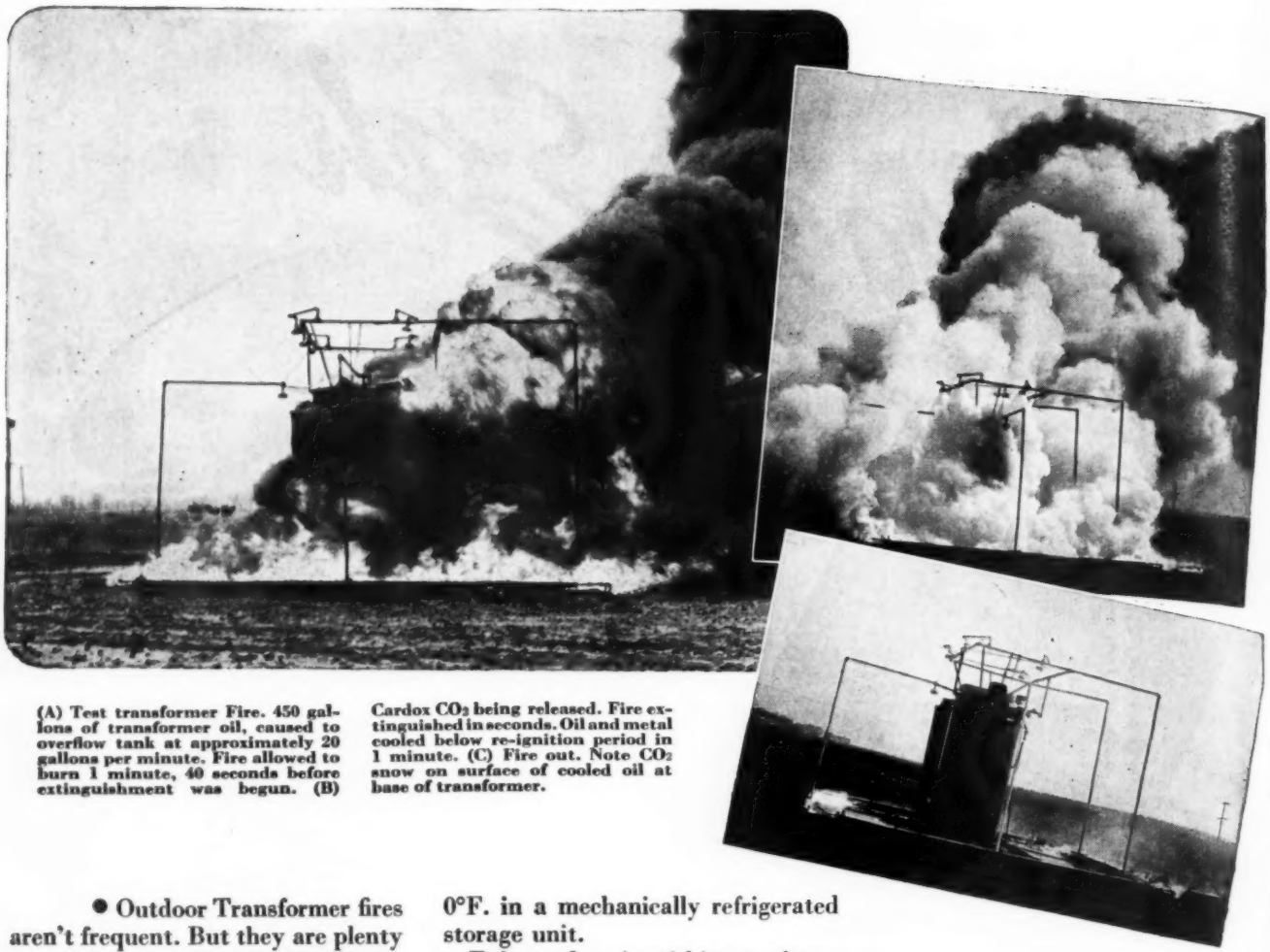
NO PLACE FOR

Too Little...Too Late



(A) Test transformer Fire. 450 gallons of transformer oil, caused to overflow tank at approximately 20 gallons per minute. Fire allowed to burn 1 minute, 40 seconds before extinguishment was begun. (B) Cardox CO_2 being released. Fire extinguished in seconds. Oil and metal cooled below re-ignition period in 1 minute. (C) Fire out. Note CO_2 snow on surface of cooled oil at base of transformer.

• Outdoor Transformer fires aren't frequent. But they are plenty tough. Large quantities of highly inflammable oil get the fire off to a fast start. Metal temperatures soar. Extinguishment and cooling must be swift, or costly equipment becomes junk. Cardox Fire Extinguishing Systems are engineered to meet just such difficult requirements.

Transformers represent only one of the many tough hazards given protection by Cardox Fire Extinguishing Systems. Engineered applications of Cardox Systems provide quick extinguishment of both large and small fires involving "A", "B" or "C" hazards, or a combination of all three types of flammables.

TONS FOR LARGE FIRES POUNDS FOR SMALL ONES

A Cardox System—engineered for the specific hazards it covers—extinguishes fires by a timed *mass* discharge of Cardox CO_2, stored at 0°F. in a mechanically refrigerated storage unit.

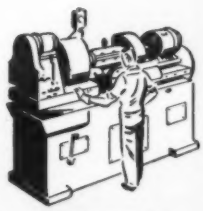
Enhanced extinguishing performance is possible because, as controlled and applied in Cardox Systems, Cardox CO_2: (1) Has uniform extinguishing characteristics regardless of plant or atmospheric temperatures; (2) Applications can be engineered to the requirements of each specific hazard covered; (3) High CO_2 snow yield provides increased cooling effect (carbon dioxide released at 0°F. yields 45% CO_2 snow); (4) Effective projection through relatively great distance is achieved —even outdoors.

If you would like more information for use in solving current war plant fire protection problems . . . or in formulating fire protection plans that will prevent dangerous delays in getting post-war production in high gear . . . write on company letterhead for Bulletin 974.

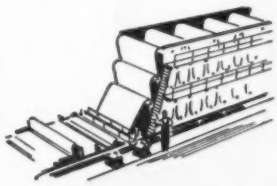
CARDOX CORPORATION
BELL BUILDING • CHICAGO 1, ILLINOIS

District Offices in
New York, Boston, Washington, Detroit, Cleveland, Atlanta, Pittsburgh, San Francisco, Los Angeles, Seattle

IF your Job calls for



FOR MACHINE TOOLS



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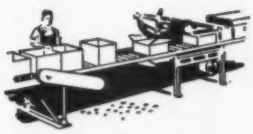
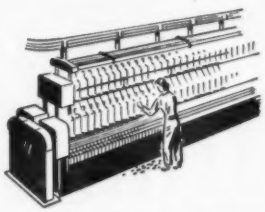
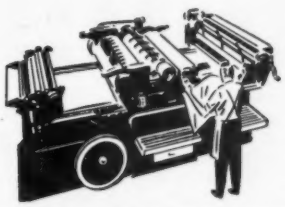


FOR CONVEYOR SYSTEMS



FOR TEXTILE MACHINERY



PRINTING OR PROCESSING EQUIPMENT

FAST AND SLO

. . . you want LOMBARD COMPACT NEW VARIABLE DRIVE

Imagine a positive variable speed drive, just the size of the motor — even in the higher horsepowers — 15, 25, 50, 100 H. P. or higher.

That's just what you get in the Lombard Transmission. Due to the new engineering approach, where 90% of the power goes through conventional gearing methods, the size of the unit is held to a minimum.

And with only 10% of the power passing through the V-Belt, the possibility of slippage in sudden changes of load is practically eliminated. This drive is proven and practical — and is backed by our 50 years of control engineering. Available with direct mechanical or remote electrical control; split casing optional.

If you want the newest in variable speed on post-war machines, or for modernization of existing equipment, write for engineering bulletins.

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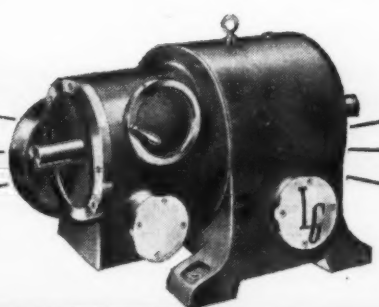
IF YOU HAVE A CONTROL PROBLEM . . . LOOK TO LOMBARD

EXTREMELY COMPACT

PRACTICALLY NO SLIPPAGE

MINIMUM MAINTENANCE



LIGHT BUT RUGGED

FINER HAIRLINE CONTROL

MAXIMUM SERVICE

Let's discuss "CARBOFRAX" and continuity of boiler furnace operation

"Carbofrax" in the clinker zone of boiler furnace settings is an important aid to continuous operation. Its use eliminates frequent and untimely outages caused by lining failures. Even at abnormal temperatures "Carbofrax" does not soften because it has an extremely high refractoriness. Furthermore, it is very resistant to both flame and mechanical abrasion so that the upper walls are well supported at all times.

Since clinkers cannot become embedded in the hard, dense face of "Carbofrax," the brickwork is unharmed during the barring operation. In fact, this work is made easier and the clinkering time is appreciably shortened.

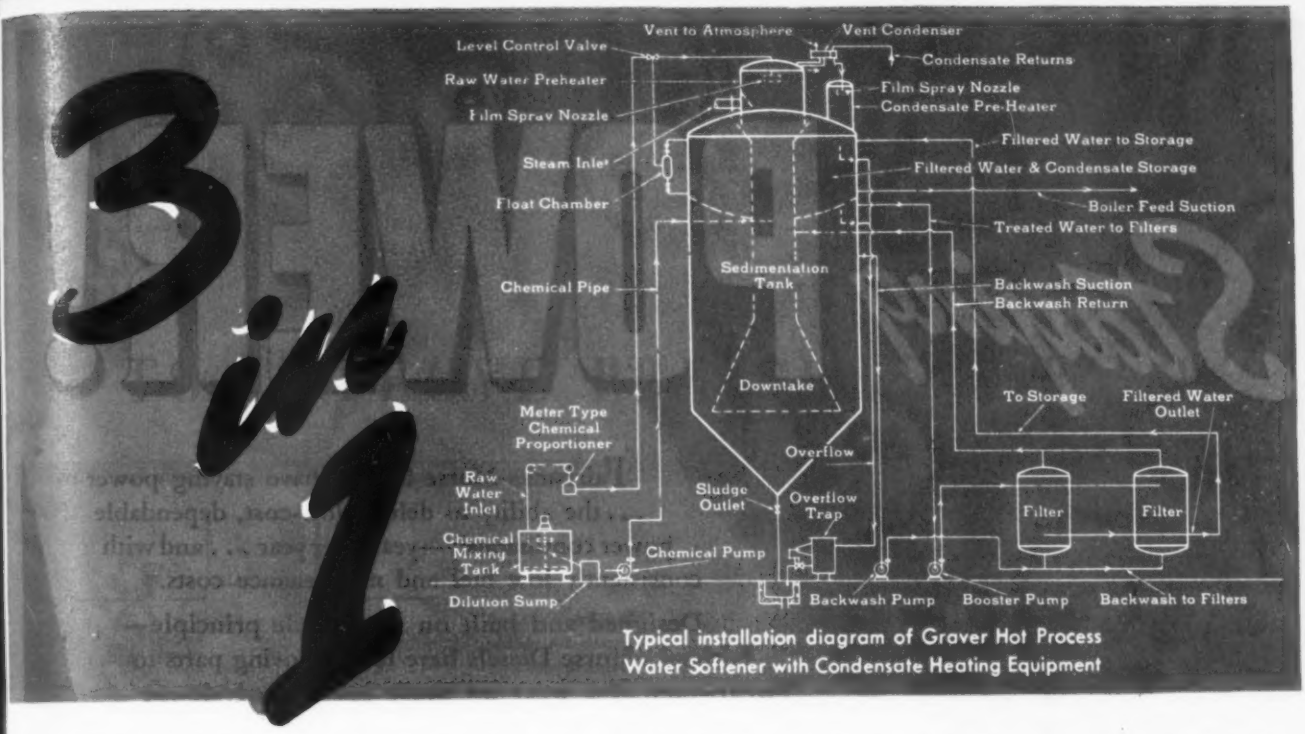
Besides helping to maintain continuity of service this Carborundum Brand Silicon Carbide Refractory provides also for maximum steaming capacity—better efficiency—reduced labor and maintenance costs.

We will be very glad to tell you more about the application of "Carbofrax" to your boiler settings promptly after request. The Carborundum Company, Refractories Division, Perth Amboy, N. J.

District Sales Branches: Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh. Distributors: McConnell Sales and Engineering Corporation, Birmingham, Ala.; Christy Firebrick Company, St. Louis, Mo.; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Company, Los Angeles, San Francisco, Calif.; Denver Fire Clay Company, El Paso, Texas; Smith-Sharpe Company, Minneapolis, Minn.

Super Refractories by CARBORUNDUM TRADE MARK

(Carborundum and Carbofrax are registered trade marks of and indicate manufacture by The Carborundum Company)



Typical installation diagram of Graver Hot Process Water Softener with Condensate Heating Equipment

FEED WATER TREATMENT

Graver Hot Process Water Softeners with built-in Deaerating Equipment provide, in a single unit, three important steps necessary to the proper conditioning of boiler feed water.

1 ***Raw water and condensate is heated with exhaust steam to within 2° of the temperature of the steam.***

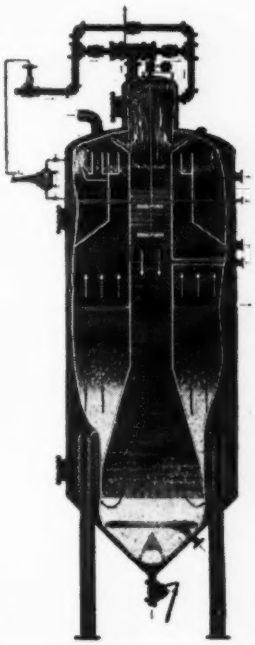
2 ***Chemicals are added to the raw water and scale-forming constituents are precipitated to provide soft water .5 gpg hardness.***

3 ***Condensate and treated raw water are deaerated for the removal of oxygen and free CO_2.***

Not only is all or part of the feed water heated, but insurance is provided against the common enemies of all boilers . . . pitting, corrosion, and scaling. Graver's many years of experience are assurance that whatever your water conditioning problem, Graver can supply the right answer.

Whatever the specific requirements of your power plant, Graver engineers will make a careful study, design equipment to do the job, fabricate and install the complete conditioning plant. With such a service, you're certain of lasting satisfaction.

Submit your requirements to Graver. Complete, unbiased recommendations and estimates are yours for the asking.



This cross-sectional view of the Graver Hot Process Water Softening and Deaerating Unit shows flow and action of feed water. Like all Graver Water Conditioning Equipment it can be built in any size that service demands.

Process Equipment Division
of

GRAVER TANK & MFG. CO., INC.

4809-25 Tod Ave., East Chicago, Ind.

NEW YORK CATASAUQUA, PA. CHICAGO TULSA

GRAVER
WATER CONDITIONING EQUIPMENT

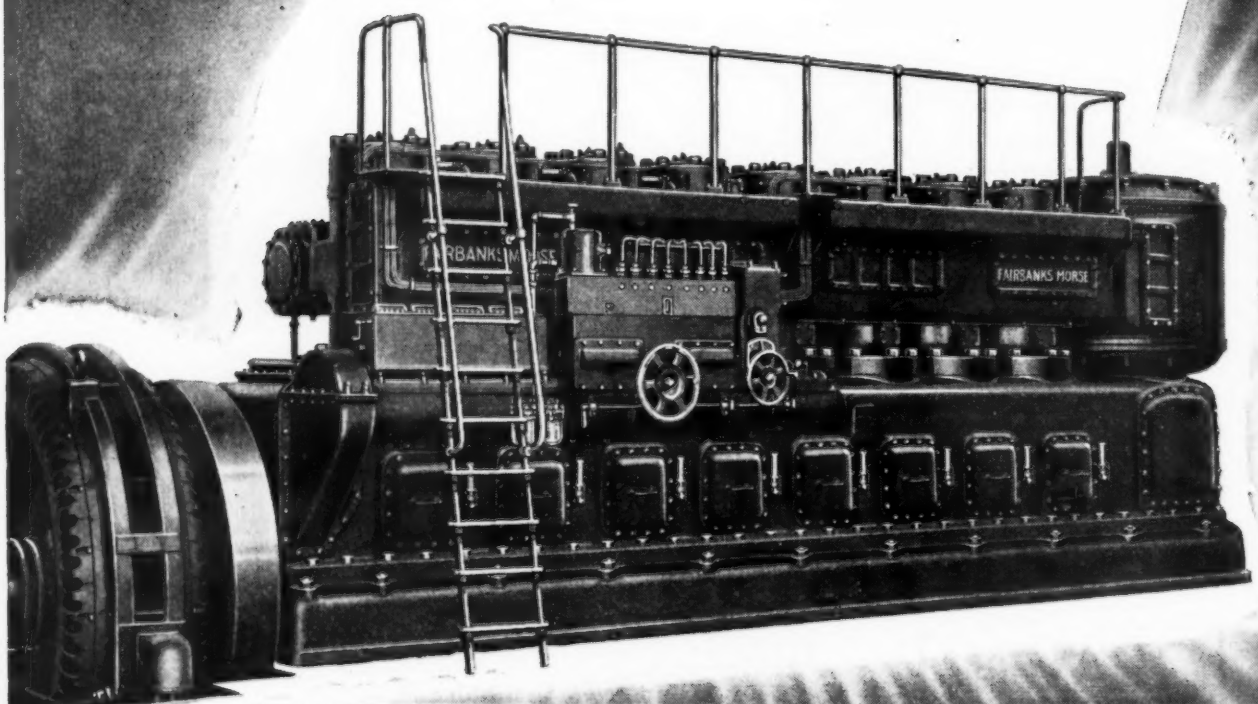
Hot Process Water Softeners—Zeolite Water Softeners—Water Filters—Iron Removal Filters—Oil Removal Filters—Reactivators—Chemical Mixing, Proportioning and Feeding Equipment

Staying POWER!

Fairbanks-Morse Diesels have staying power . . . the ability to deliver low-cost, dependable power continuously—year after year . . . and with consistently low fuel and maintenance costs.

Designed and built on the 2-cycle principle—Fairbanks-Morse Diesels have fewer moving parts to wear—and less wear on those because of slower operating speeds.

If you need more power or lower-cost power, have a Fairbanks-Morse engineer study your problem. There is no obligation. Write Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois. Branches and service stations throughout the United States and Canada.



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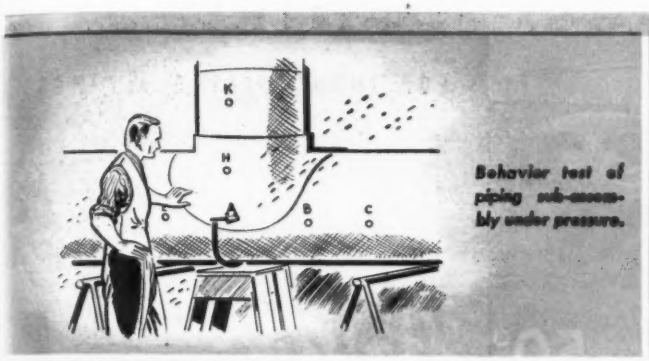
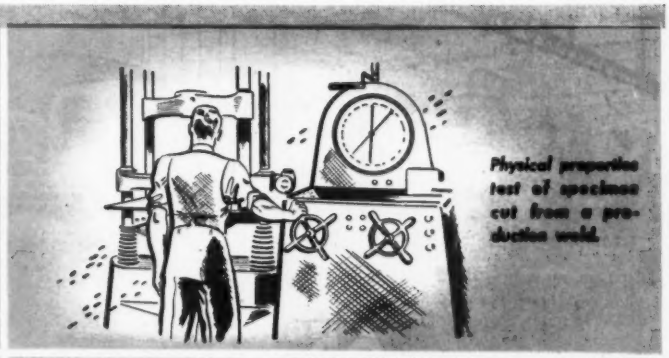
TO IMPROVE PRESSURE PIPING

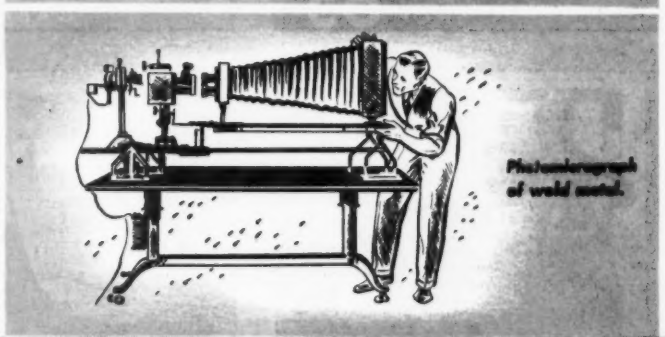


Behavior test of piping sub-assembly under pressure.



Physical properties test of specimens cut from a production weld.

Chemical analysis of weld metal.



Photomicrograph of weld metal.

Members of the Pipe Fabrication Institute conduct continuous research for the improvement of pressure piping in general, and pre-fabricated piping in particular. It is research which makes the qualified fabricator ready with improvements when they are needed —able to meet the new piping demands which are constantly arising. The result is substantial savings to industry.

Behavior of piping sub-assemblies under pressure and temperature . . . physical tests of weld specimens . . . chemical analyses to determine possible chemical changes produced by welding . . . photomicrographic inspection of weld sections . . . X-raying, etc., reveal much important data used in maintaining close control and supervision over the whole shop fabricating process.

Any qualified pipe fabricator will make such data available to help you secure piping which exactly meets your requirements.

P.F.I. THE PIPE FABRICATION INSTITUTE

THE PIPE FABRICATION INSTITUTE

Devoted to the Technical and Economic Problems in Piping

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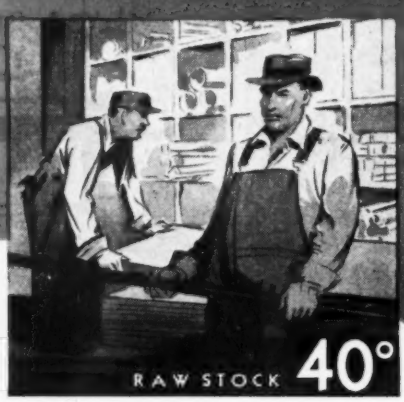


FUEL SAVING ZONE CONTROLS

FOR INDUSTRIAL BUILDINGS

Available NOW!

YOU CAN COMMENCE NOW—not planning alone—but actual preparation to gain greater operating efficiency, increased operating economy . . . the two factors vital for successful factory management.

Minneapolis-Honeywell Fuel Saving Zone Control equipment is available for installation now. It provides a temperature control system tailor-made to suit the individual needs of your plant. Thus you can maintain in each "zone" of the building, the exact temperature required. Compensation is made for all varying elements usually encountered . . . outside weather, construction of the building, the time of occupancy and the kind of operation being conducted.

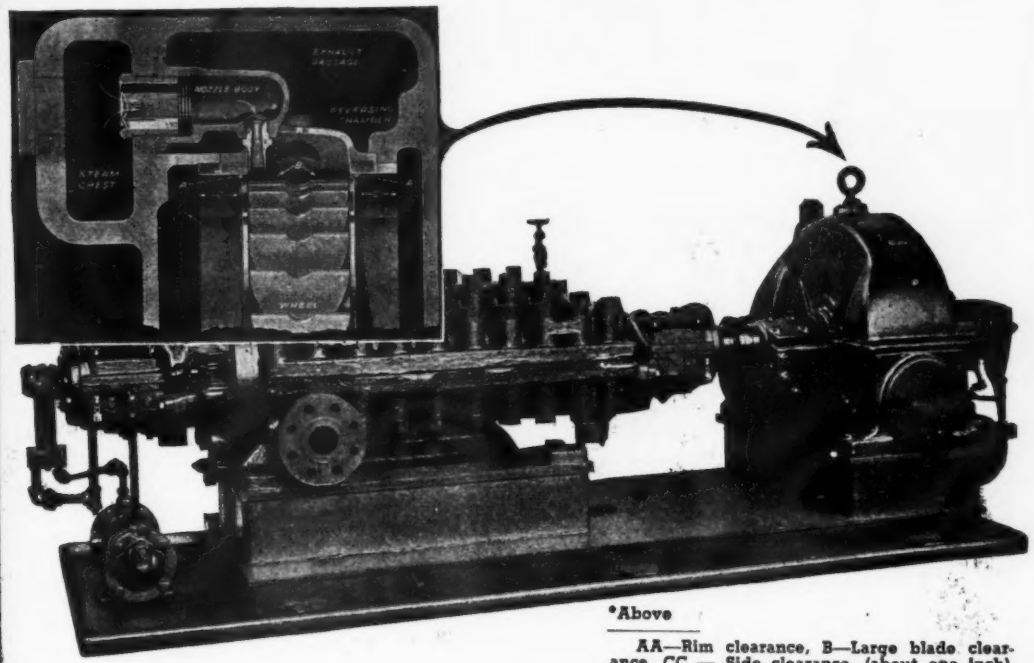
Lowered fuel cost however, is the important advantage. Heat saved in low temperature areas is used, *without waste,* to heat sections requiring higher temperatures. The cost of installation, surprisingly low, can actually pay for itself in fuel savings . . . You can arrange quickly for a fuel saving survey of your building, without cost or obligation. Call the Minneapolis-Honeywell office in your city, or write Minneapolis-Honeywell Regulator Company, 2702 Fourth Ave. S., Minneapolis 8, Minn. Branches in principal cities.

MINNEAPOLIS **Honeywell**

CONTROL SYSTEMS

Back The Attack—Buy MORE Than Before!

TERRY



*Above

AA—Rim clearance, B—Large blade clearance, CC — Side clearance, (about one inch). Blades cannot foul, as they are protected by rims. Rubbing at AA will do no damage. Side clearance is so large that end-play from excessive external thrust cannot damage wheel.

END PLAY WILL NOT DAMAGE THE BLADING OF THE TERRY WHEEL TURBINE

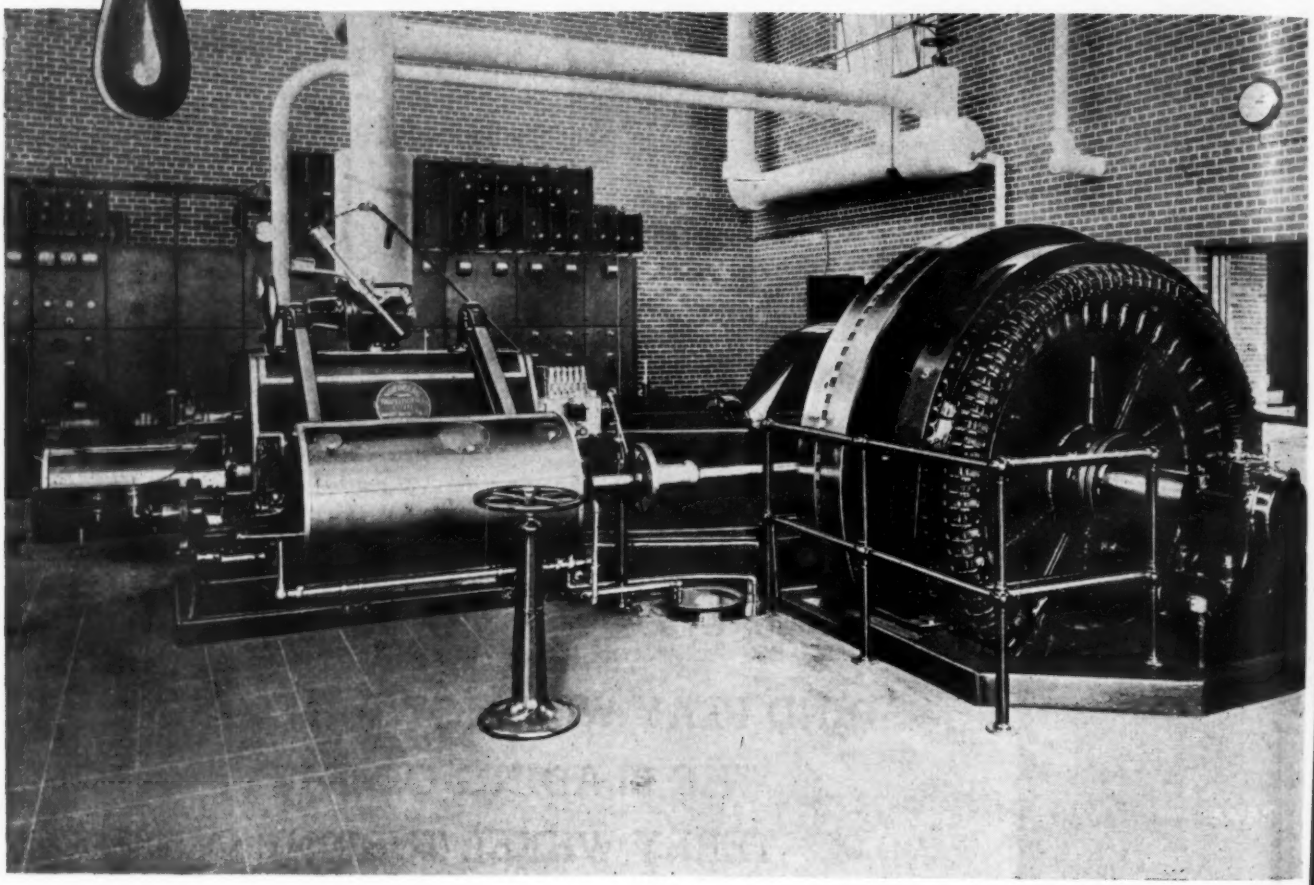
In the Terry Wheel Turbine the blades are protected by rims at the sides of the wheel, which would take without damage any rubbing that might occur if the clearance became reduced. With this construction it is impossible for the blades to foul and frequent inspection of the thrust bearing is not required to obtain safe and dependable operation.

The Terry Wheel Turbine is fully described in our Bulletin S-116. A request on your business letterhead will bring a copy.

T-1133

THE TERRY STEAM TURBINE COMPANY
TERRY SQUARE, HARTFORD, CONN.

CORRECT Lubrication means *Better Maintenance*



PROBLEM—excessive wear, difficult maintenance.

SOLUTION – *Correct* lubrication.

Sinclair STEAM CYLINDER and VALVE OILS provide *correct* lubrication for steam plants. These oils meet all requirements from extremely wet to highly superheated steam conditions . . . suit all engine designs, operating characteristics.

If maintenance is your worry you have a lubrication problem. Let us tell you how Sinclair lubricants make for *better maintenance.*

(Write for "The Service Factor"—published periodically and devoted to the solution of lubricating problems.)

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE SINCLAIR REFINING COMPANY, 630 FIFTH AVENUE, NEW YORK 20, N. Y.

Scale-smashers by ELLIOTT

This group of aids to boiler health is a small part of many now in service on Maritime Commission vessels. These cleaners, all water-driven, are for 2 in. and 4 in. tubes. The larger cleaners are equipped with universal joints for use in curved tubes.

Afloat and ashore, Elliott tube cleaners are at their best in any tube that can be cleaned. They combine powerful motors, armed to the teeth with tough, hard, trackless cutters in cutter heads that will stand the gaff of heavy service. They are the final up-to-the-minute word in scientifically designed tube cleaning equipment, developed through many years of research and experience.

If you have a tube cleaning problem, Elliott has the tool for it and the experience to back it up. Write us.

ELLIOTT COMPANY
TUBE CLEANER DIVISION, SPRINGFIELD, OHIO
DISTRICT OFFICES IN PRINCIPAL CITIES

Elliott cleaners

for tubes of every kind, everywhere

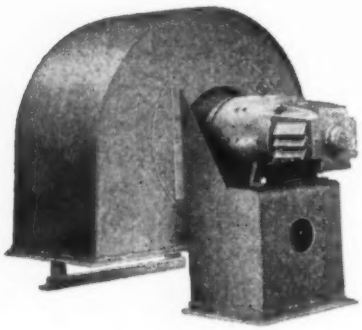
Y-210

INVEST IN VICTORY:
Buy More War Bonds!

OVER 1000 NEW SHIPS

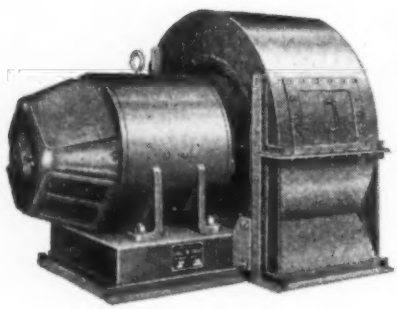
ARE CLARAGE EQUIPPED

Including warships from battle wagons and flat tops to landing barges — and, of course, hundreds of cargo ships . . . the ALL-STEEL construction and space-saving designs (20 to 35% greater compactness) of Clarage Fans what most builders like best!



VENTILATING FANS

Built from sheet steel, hot-dipped galvanized — *no cast iron.* Inlet and outlet flanges, drain cocks, clean-out doors, and other special features where specified. As in all Clarage Fans, *wheels statically and dynamically balanced,* insuring dependable performance and quiet operation. Sizes to meet all requirements.



FORCED DRAFT FANS

Heavy sheet steel construction — *no cast iron.* Full self-limiting horsepower characteristic, *preventing capacity overloads and burned out motors.* High speed design — suitable for direct motor or steam turbine drive. Both forced and induced draft fans built in sizes to handle any service condition.

Partial Roll Call of Shipbuilders Using Clarage Fan Equipment

United States Navy
Alabama Shipbuilding & Drydock
American Shipbuilding
Astoria Marine Construction
Bellingham Marine
Bethlehem Steel
Camden Shipbuilding
Cape May Shipbuilding
Cargill, Inc.
Charleston Shipbuilding & Drydock
Colbert Boat Works
Cramp Shipbuilding
Federal Shipbuilding & Drydock
Gulf Shipbuilding
Ingalls Shipbuilding
Kaiser (various yards)
Los Angeles Shipbuilding & Drydock
Lynch Shipbuilding
Manitowac Shipbuilding
Maryland Drydock
Moore Drydock
Newport News Shipbuilding & Drydock
New York Shipbuilding
Seattle Tacoma Shipbuilding
Snow Shipyards
Tampa Shipbuilding
Todd Shipyards
Toledo Shipbuilding
United Engineering
Western Pipe & Steel

But serving the marine field is only a part of our 100% war effort. Equally important is our obligation to other types of essential industry, where Clarage air handling and conditioning equipment plays a vital part in speeding production, insuring uniformity of product, reducing absenteeism.

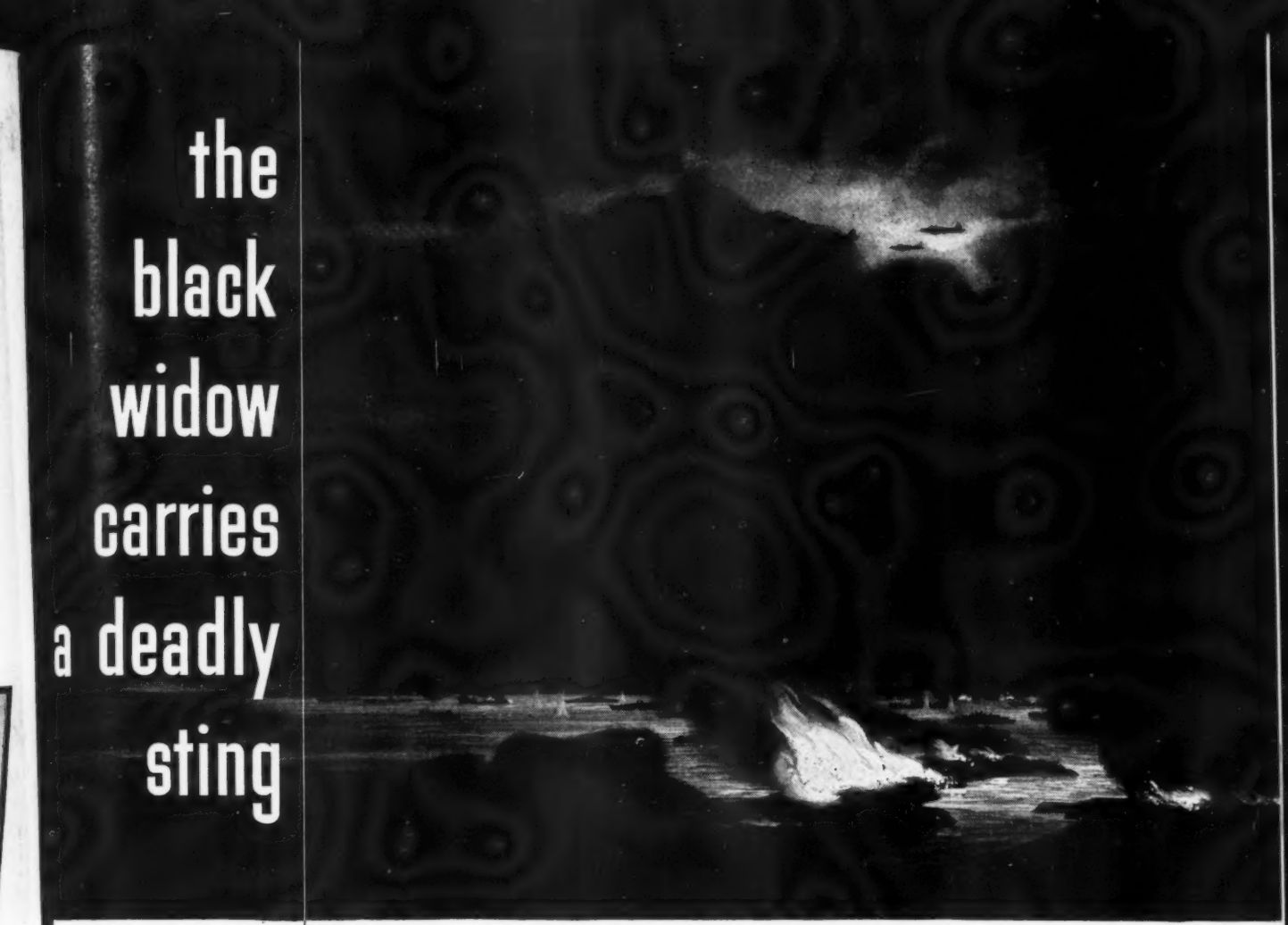
★ If you have any kind of problem in our field, it will pay you to consult with the nearest Clarage application engineer. Call our branch office in your city, or write us at Kalamazoo. *Deliveries can be made promptly.*

COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

Clarage Fan Company Kalamazoo, Mich.

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

the black widow carries a deadly sting

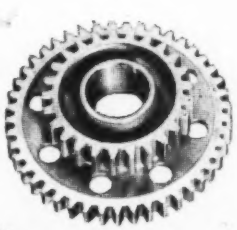


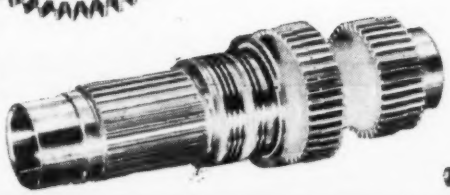
A DARK shadow streaks across the night sky. A newcomer enters the battle on the side of Democracy. Bearing a lethal sting, the Black Widow, America's newest night fighter, packs the power to destroy anything that flies. Swift as an arrow, formidable as its famed namesake, this new ship, designed by Northrop, in co-operation with the Army Air Force's Matériel Command, promises a deadlier weapon to the men who are bringing victory to the United Nations.

And in the Pratt & Whitney engines that drive this most powerful of all pursuit planes are Foote Bros. Gears—gears that of necessity meet new standards in metallurgical and dimensional perfection.

The Black Widow forecasts a new conception of design for the world of tomorrow—an era where high speed, the demand for greater efficiency, will find new uses for high precision gears. The engineering skill, production technique, manufacturing know-hows that have made possible the mass production of gears of such high precision may suggest applications in the development of machines you are designing for a world at peace.

FOOTE BROS. GEAR AND MACHINE CORPORATION • 5225 S. Western Blvd., Chicago 9, Ill.





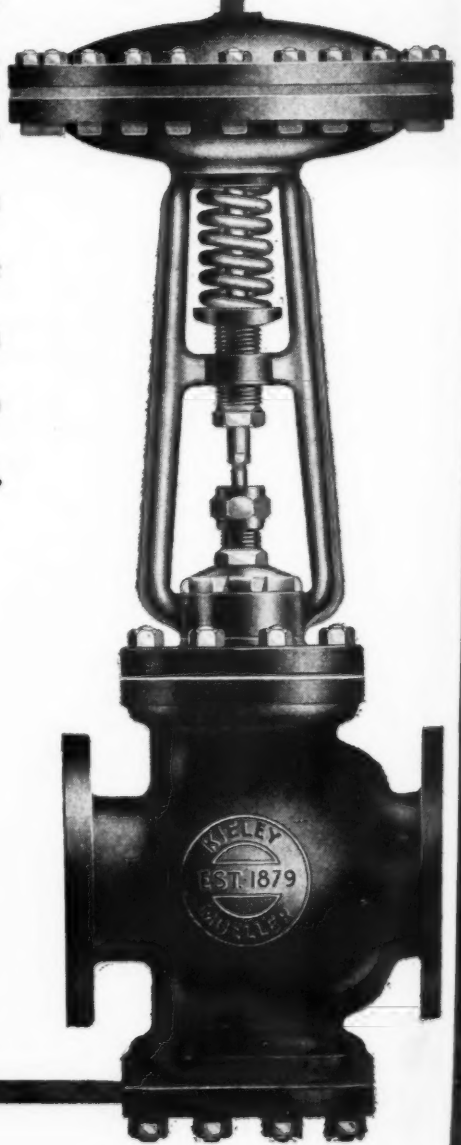
FOOTE BROS.

Better Power Transmission Through Better Gears

Is there anything the Army Engineers can't do?

JACK OF ALL TRADES . . . AND *MASTER* TOO!

One of the most versatile—yet unerringly accurate reducing valves. Regulates oil, gas, steam, water or air under constant or pulsating initial pressures up to 300 lbs. The reduced pressure range is from 1 lb. to 75% of inlet, not exceeding 125 lbs. Pressure setting is easily adjusted. Inner valve construction assures proper seating and minimum pressure drop at full valve opening. Beveled discs are standard, with other tyes available.



Write for General Catalog 66

TYPES	SIZE, IN.	BODY MATERIALS
422	½" to 3" ½" to ¾" 1" to 12"	Semi-steel or Cast-steel Bronze Standard or X Heavy Semi-steel or Series 15, 30 or 40 Cast-steel
423	½" to 2"	Bronze or Cast-steel
425	2" to 8"	Semi-steel or Cast-steel

KIELEY & MUELLER, INC.
MANUFACTURERS OF PRESSURE AND LEVEL CONTROLS
NORTH BERGEN, NEW JERSEY

Steel takes the Backache out of Monday

THIS is Monday in Europe. Even after the war, this age-old routine, familiar to every Continental village, must continue. Steel is too scarce and too expensive over there for most people to enjoy the household facilities that we take so much for granted.

Plentiful, low-cost steel relieves American women of drudgery--makes available to the masses the "luxuries" of running water, automatic laundry equipment, refrigerators, ranges. There is no other metal sufficiently abundant or suitable to take over this job.

For 42 years, Youngstown has helped to convert America into a nation of running water--supplying millions of miles of durable, low-cost steel pipe, fabricated by constantly improved, more efficient methods. Youngstown has also supplied steel sheets for millions of washers and tubs, ranges, refrigerators and other home equipment.

Now, war's demands for steel are being satisfied. But soon we shall resume the unfinished job of suppling you, our customers old and new, with dependable, economical pipe and sheets to further eliminate drudgery and advance the American standard of living.

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

Manufacturers of

CARBON - ALLOY AND YOLOY STEELS

Pipe and Tubular Products - Sheets - Plates - Conduit - Bars - Tin Plate
Rods - Wire - Nails - Tie Plates and Spikes - Alloy and Yoloy Steels

Let's forget all this talk of

Post-War Dreaming . . .

Let's forget for a moment those "miracle" homes and visionary automobiles—those "magical" new materials and revolutionary revisions in manufacturing methods. Let's just consider one fundamental, time-tested truth: industrial progress has always been evolutionary . . . never revolutionary.

But the evolutionary pace of industrial improvement has quickened with the war. And because post-war competition will be severe — brutally severe — far-sighted production engineers are asking themselves some searching questions:

"Will our existing operational systems deliver profitable production in a highly competitive market? . . . Will our older machinery slow down production—prove too costly under carefully computed accounting? . . . Is there a possibility our new machinery may be obsolete after the war?"

Robins, the originator of conveying with a troughed shaped Belt, is constantly answering such questions for a wide variety of industries that use materials handling machinery. For instance, Robins engineers recently made a complete production analysis in a large industrial plant. The results included the elimination of one entire and costly operation which the officers hadn't even dreamed could be eliminated.

After Robins had demonstrated improvements in operational methods, auxiliary machinery was designed and built which increased the capacity of older, existing equipment. As the result of these changes, the entire war production of the plant was increased, operating costs were lowered . . . and the future competitive position of the company was immeasurably strengthened.

And yet this company had not realized that such improvements were possible until Robins had completed its analysis.

Perhaps there are similar "unknowns"—as well as "knowns"—in your own plant. If you will explain your conditions fully, a Robins engineer from any of our ten branch offices is available for consultation without cost or obligation. When writing, please address Dept. P-7.

ENGINEERS • MANUFACTURERS • ERECTORS

ROBINS CONVEYORS INCORPORATED
Founded in 1896 as Robins Conveying Belt Co.
PASSAIC • NEW JERSEY

ROBINS *makes:* BELT CONVEYORS • COAL AND ORE BRIDGES • BUCKET ELEVATORS • CAR AND BARGE HAULS • CAR DUMPERS • CAR RETARDERS • CASTINGS • CHUTES • CONVEYOR IDLERS AND PULLEYS • CRUSHERS • FEEDERS • FOUNDRY SHAKEOUTS • GATES • GEARS • GRAB BUCKETS • PIVOTED BUCKET CONVEYORS • VIBRATING SCREENS • SCREEN CLOTH • SELF-UNLOADING BOAT MECHANISMS • SKIP HOISTS • STORAGE AND RECLAIMING MACHINES AND SYSTEMS • TAKEUPS • LOADING AND UNLOADING TOWERS • TRIPPERS • WEIGH LARRIES • WINCHES • WINDLASSES

FOR MATERIAL AID IN MATERIALS HANDLING . . . . . It's ROBINS

MATERIALS HANDLING MACHINERY

I'd rather have my valves DEXTER-RESEATED than break in new ones

Here's why . . . An old valve is "comfortable" — like an old pair of shoes. It has worked into its job: None of that s-t-r-e-t-c-h and take-up that seems to unsettle a new valve on the line . . . the old fellow is a part of the system — you can depend on him.

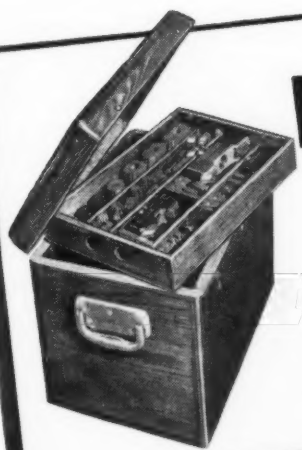
When it leaks, you're better off if you reseat the valve right on the line. Just remove the bonnet and put in a Dexter Valve Reseating Machine. Make a few adjustments — turn the crank a few times — and you've got a clean-cut seat that's actually better than new. Now reface the disc and put it back in the valve, and your old friend is ready to carry on.

Personally, I'd go a long way to save an old valve — but by reseating with a Dexter Outfit I also save time, avoid costly shutdowns, and don't have to buy a new valve — which isn't always easy these days.

What's your valve leak problem?

Just drop us a line, giving us the make, type, size and material . . . whether water, air or steam, and the pressure. We'll give you the Dexter answer to your problem and suggest the proper Dexter Valve Reseating Outfit for you.

15



DEXTER VALVE RESEATING MACHINES AND CUTTERS

FOR GLOBE, GATE AND PUMP VALVES

THE LEAVITT MACHINE COMPANY
ORANGE, MASSACHUSETTS

HAVING MOISTURE TROUBLE?

SIMPLY APPLY UNIBESTOS
it's simple to apply!

Unibestos efficiency is unaffected by excessive moisture—is ideal for outdoor work or underground mains. Even when Unibestos is soaked, moisture can be steamed off without damaging its structural strength. No shrinking or sagging—Unibestos remains snug and firm against the pipe—thus always assures maximum protection with a minimum of heat loss.

Available in half-section form up to 30" pipe diameter and in quarter sections from 32" to 60", in thicknesses from ¾" to 5". Single layer construction available for service up to 1200°.

UNION ASBESTOS
MEANS PROGRESS IN INSULATION
AND RUBBER CO.

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UNION ASBESTOS AND RUBBER CO.

PLANTS: 1821 S. 54th Ave., CICERO, ILL. • PATERSON, N. J. • BLUE ISLAND, ILL.
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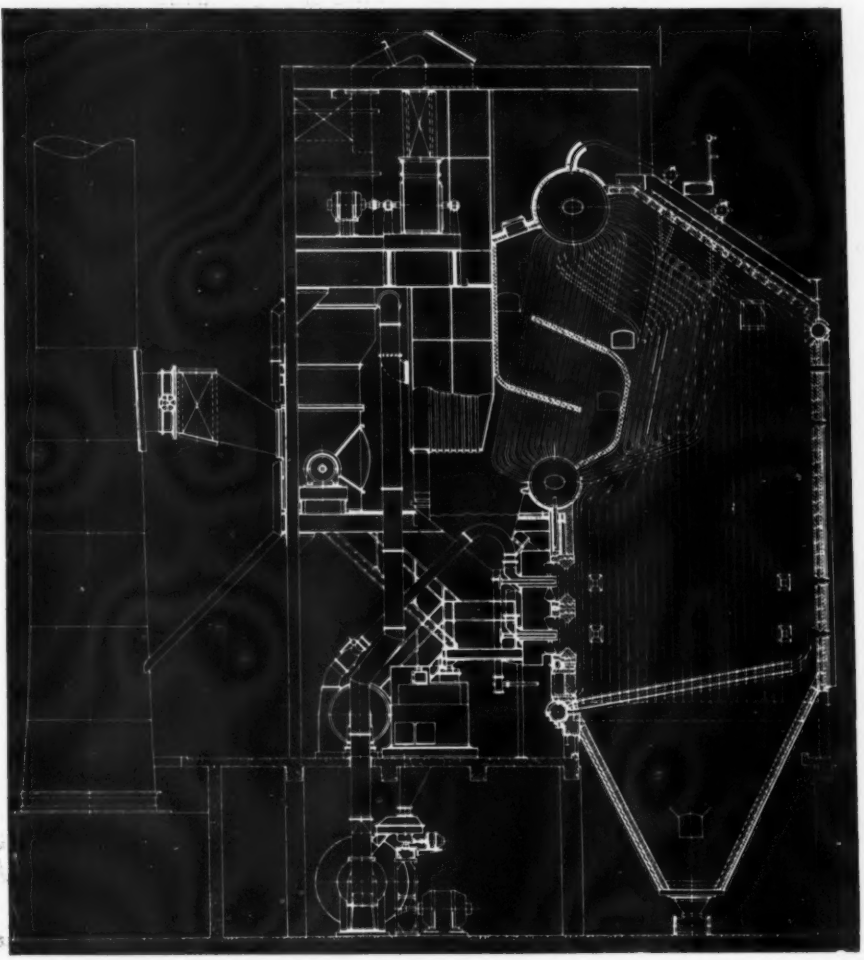
ONE SUCCESSFUL JOB LEADS TO ANOTHER

The engineers of an Eastern plant were faced with the problem of obtaining the best overall steam generating equipment to meet their increased steam requirements with lower grade coal, the equipment to be supplied under one responsibility.

A thorough investigation was made, with the result that Kennedy Equipment was selected and installed on the basis of outstanding performance. The records from which selection was made disclosed long service, continuous pulverization at 85 to 95% through 200 mesh and low maintenance cost for KENNEDY AIR Swept Tube Mills together with high efficiency, non-restricted circulation, high steam output and low maintenance cost for KENNEDY Shadow-Wall Steam Generators.



KENNEDY Steam Generator, 600 lbs. pressure, 750 degrees F. total temperature, 75,000# per hour.

KENNEDY EQUIPMENT INSTALLED ON THIS JOB

Fine grinding, efficient burning of low grade abrasive coals and maximum steam output at minimum maintenance cost are assured in this industrial plant through the installation of the following equipment all of which was furnished complete by KENNEDY-VAN SAUN.

KENNEDY Shadow Wall Steam Generator
KENNEDY Integral Superheater
KENNEDY Air Swept Tube Mill
KENNEDY Pulverized Coal Burners
KENNEDY Totally Enclosed Coal Feeder
KENNEDY Mill Level Control
KENNEDY Herculite Steel Lined Coal Fan
KENNEDY Tubular Multipass Air Heater

COMPLETE ENGINEERING SERVICE

KENNEDY-VAN SAUN offers a complete steam power plant service under one responsibility, which includes supplying complete steam generating units, pulverizing equipment, burners, fans, coal elevators, bunkers, coal weighing scales, ash conveyors and necessary equipment. Ask for complete details.

WRITE FOR BULLETIN 12

Let our engineers help you with your special problems of burning lower grade coal to meet your production requirements.

Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

2 PARK AVE., NEW YORK 16, N. Y.
Factories: Danville, Pa., Canada, England, Australia

THIS BOOK TELLS YOU HOW TO DO IT—MAIL COUPON

ARMY E NAVY

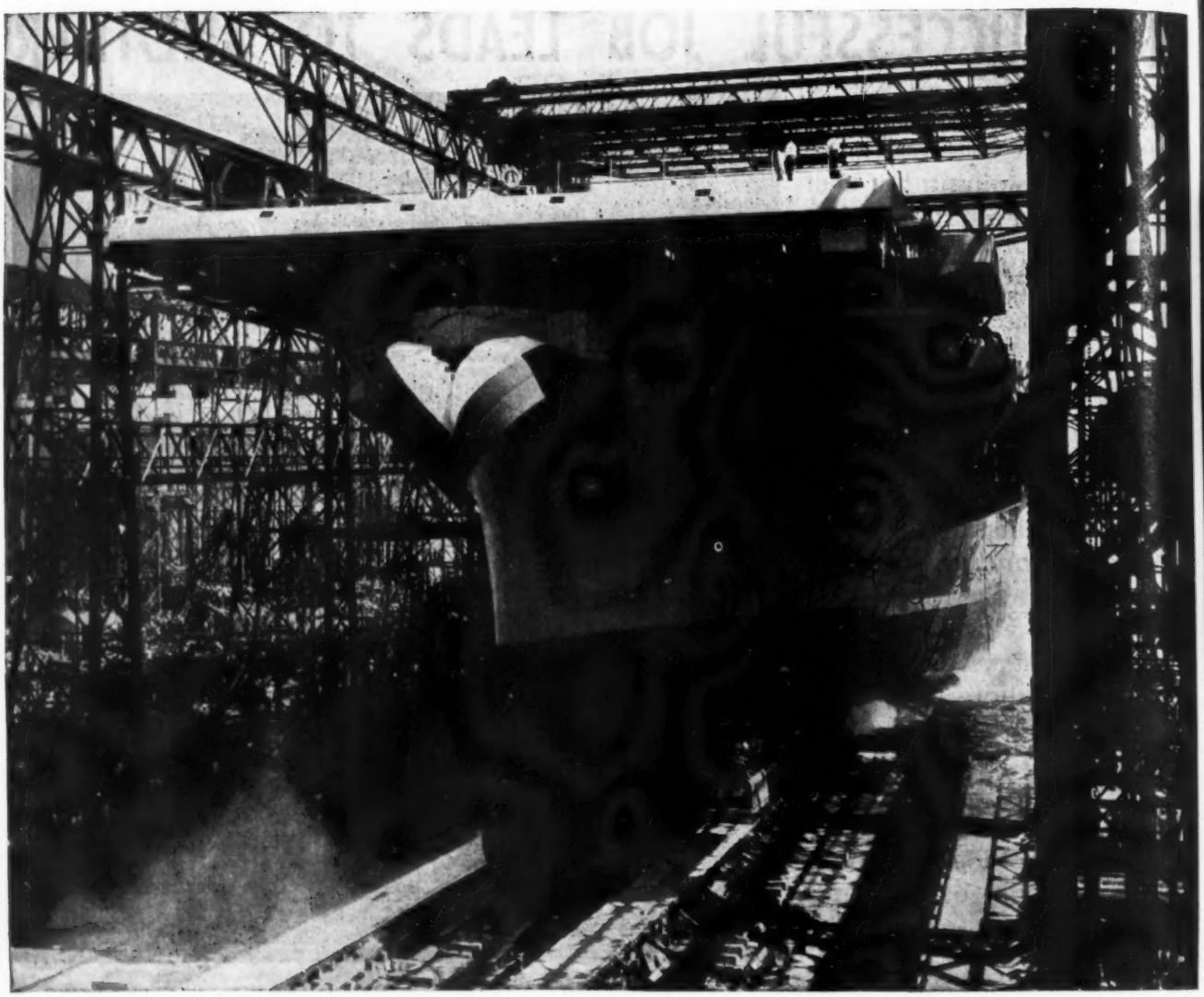
Kennedy-Van Saun Mfg. & Engr. Corp., 2 Park Ave., New York 16, N. Y.

Kindly send me Bulletin No. 12 explaining how lower grade coals can be burned efficiently;

Name ..... Position.....

Company .....

Address P-7-44



A New U.S.S. Wasp, Aircraft Carrier, goes into the water...

Many U. S. warships, battleships, aircraft carriers, and smaller craft are equipped with a considerable "mileage" of Globe Seamless Steel Tubes . . . for boiler tubing, steam lines, water lines, compressed air lines, etc.

Globe Seamless Steel Tubes are made in a wide range of sizes and wall thicknesses to act as "arteries and capillaries" carrying fluids and energy to all parts of the ship.

• • •

Globe Engineers will be glad to work with you on any steel tubing problems, large or small.

GLOBE TUBES

★ STAINLESS TUBES
★ BOILER TUBES
★ GLOBEIRON TUBING
★ GLOWELD TUBES
★ CONDENSER AND HEAT EXCHANGER TUBES
★ MECHANICAL TUBING

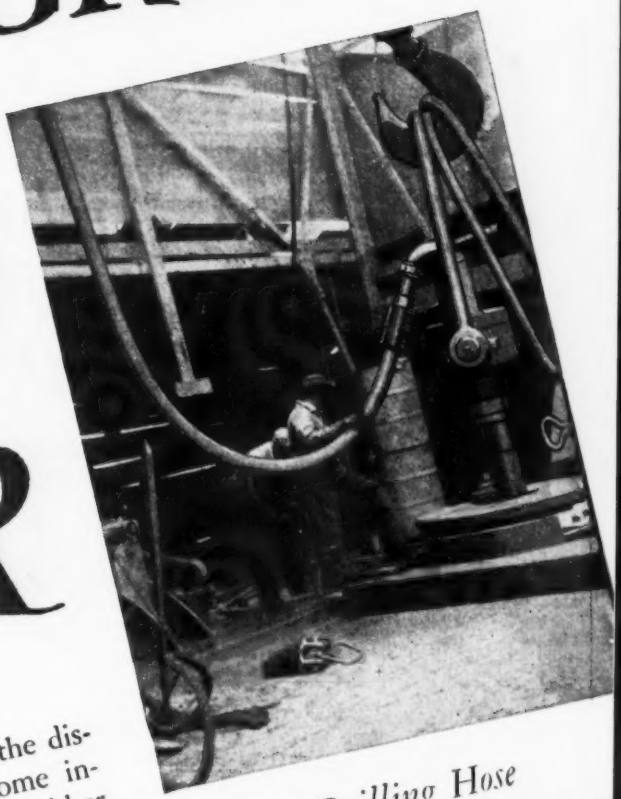
GLOBE STEEL Tubes

5010

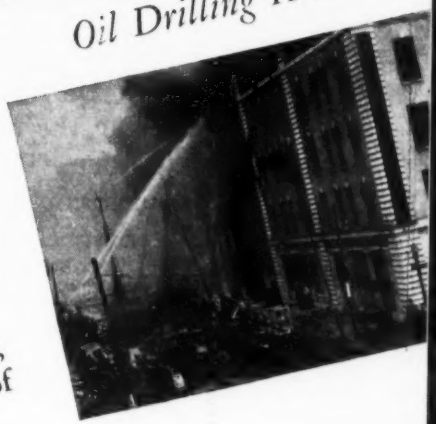
GLOBE STEEL TUBES CO., Milwaukee 4, Wis., U.S.A.

PROGRESS with RUBBER

Conveyor Belts



Oil Drilling Hose



Fire Hose

IN THE last hundred years, since the discovery of vulcanization, the progressing world has become increasingly dependent on rubber. Natural and man-made rubber both have those unique properties—elasticity and resilience—possessed by no other material. These two physical characteristics have made it invaluable in products for industry, transportation and even domestic life.

When chemically and physically reinforced, then vulcanized, rubber becomes capable of a myriad of tasks. Huge Republic conveyor belts handle loads of rock, high pressure hose helps drill for oil, Republic cotton jacketed hose fights fire, radiator hose cools automobile engines.

Republic's years of research and manufacturing experience, exclusively in mechanical rubber products, assures industry of quality when a Republic Distributor handles the order.

WE ARE PARTICIPANTS IN THE OWNERSHIP AND OPERATION OF NATIONAL SYNTHETIC RUBBER CORPORATION

REPUBLIC RUBBER

YOUNGSTOWN 1 • • OHIO

HOSE • BELTING • MOLDED GOODS PACKING • EXTRUDED PRODUCTS

DIVISION OF

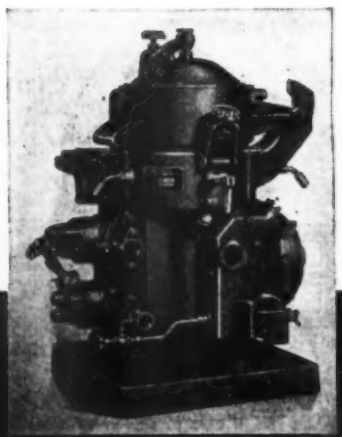
LEE RUBBER & TIRE CORPORATION

PURIFIED LUBRICATING OIL

SCANT attention was paid to the lubrication of the Asiatic water wheel. Today, however, the problem of maintaining highly refined turbine or engine lubricating oil in best possible condition confronts every power engineer. To keep these lubricants as close as possible to "new oil" quality, nothing exceeds the all-around effectiveness of the De Laval Oil Purifier.

De Laval Oil Purifiers utilize centrifugal force to remove instantaneously the impurities normally collected in service — water, sludge, carbon or dirt. The secret of De Laval's success lies in the design of the De Laval purifying bowl which so completely removes these impurities that the constantly purified oil performs at full efficiency indefinitely.

Whether the application is for a 125,000-kw. turbine or a relatively small Diesel engine, the degree of protection afforded by De Laval Oil purifiers is equally high. There is a range of types and sizes to assure the proper machine for every power plant. Write for additional information.

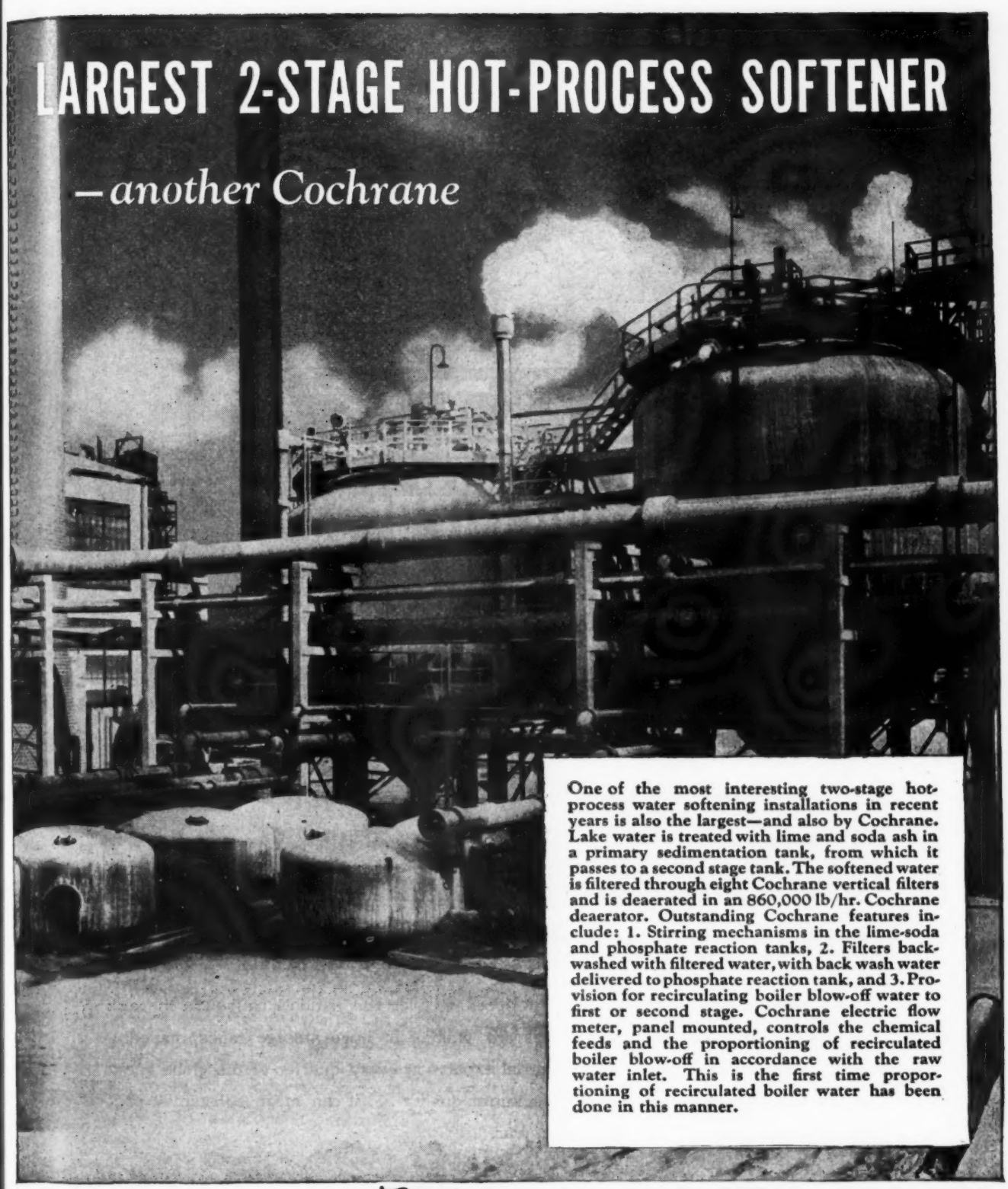


THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 — 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL — PETERBOROUGH — WINNIPEG — VANCOUVER

DE LAVAL OIL PURIFIERS

LARGEST 2-STAGE HOT-PROCESS SOFTENER

—another Cochrane



One of the most interesting two-stage hot-process water softening installations in recent years is also the largest—and also by Cochrane. Lake water is treated with lime and soda ash in a primary sedimentation tank, from which it passes to a second stage tank. The softened water is filtered through eight Cochrane vertical filters and is deaerated in an 860,000 lb/hr. Cochrane deaerator. Outstanding Cochrane features include: 1. Stirring mechanisms in the lime-soda and phosphate reaction tanks, 2. Filters backwashed with filtered water, with back wash water delivered to phosphate reaction tank, and 3. Provision for recirculating boiler blow-off water to first or second stage. Cochrane electric flow meter, panel mounted, controls the chemical feeds and the proportioning of recirculated boiler blow-off in accordance with the raw water inlet. This is the first time proportioning of recirculated boiler water has been done in this manner.

COCHRANE CORPORATION 3106 N. 17th Street, PHILADELPHIA 32, PA.

COCHRANE

SOFTENERS • DEAERATING SOFTENERS • DEAERATORS • METERS • STEAM SPECIALTIES

MILLIONS OF GALLONS FOR INVASION

After being processed in tall towers and speeding over the nation's railroads by tank cars, millions of gallons of fighting fuel are waiting in huge storage tanks made by General American. Military and industrial experts in every quarter of the globe know that the GATX triangle symbolizes maximum quality . . . it can mean substantial production economies for *you*, in peace as in war.

GENERAL AMERICAN TRANSPORTATION CORPORATION

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PLATE & WELDING DIVISION
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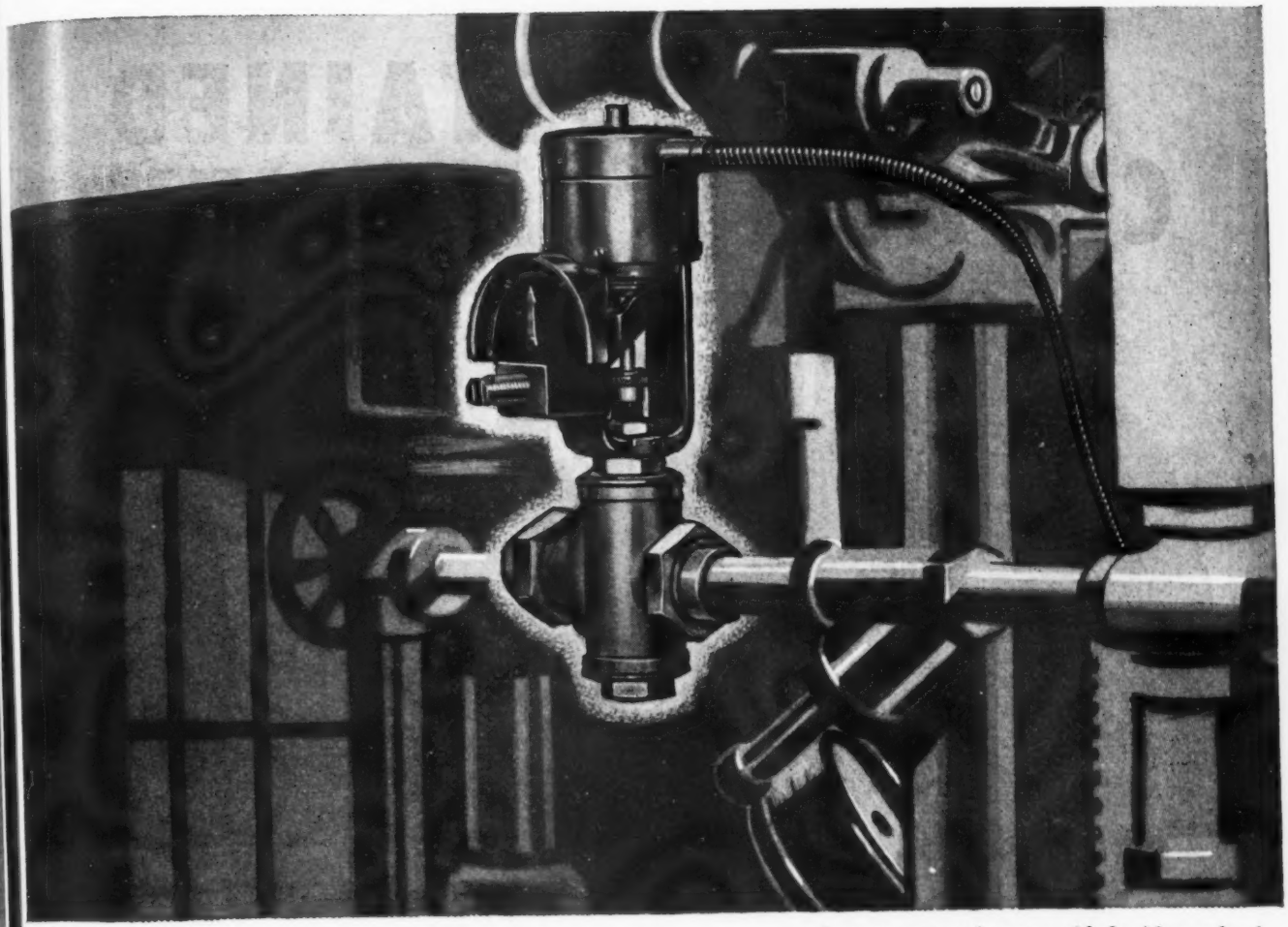
Specialists in plate fabrication — manufacturers of pressure vessels of steel, alloys and aluminum—all classes of welding — process equipment of all types—chemical engineering laboratories and service—completely equipped field erection department.



A compact regulator provided with crank adjustment to facilitate quick change of temperature setting. Many other types available.

IT RATIONS THE STEAM—

THE ACTUAL TEMPERATURE of the vat, dryer or other process equipment directly governs the volume of steam admitted to the heater coils. Peak loads, room temperatures and similar variants do not affect the fully-modulated action of the Sylphon Regulator. Even a rise of one degree is immediately reflected by a reduction in the steam supply.

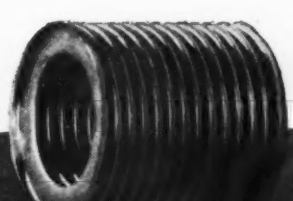
Sylphon Regulators are completely self-contained and self-powered. The temperature changes themselves create the energy to regulate valves or other control mechanisms.

, , ,

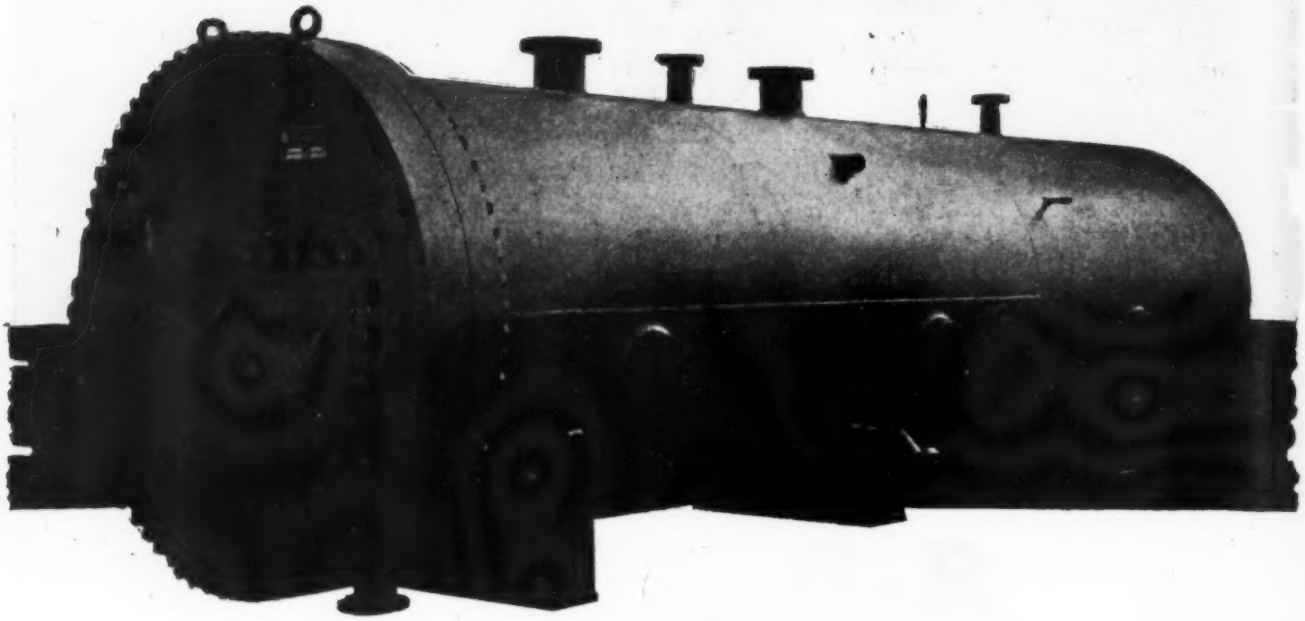
A complete line of standard Sylphon Temperature Regulators is available . . . regulators that automatically control steam, water and air. Why not look into the time, material and labor savings these devices can make for you? Send for Catalog NS-20.

ARMY E NAVY

FULTON SYLPHON



For SUSTAINED CAPACITY...PURITY of Boiler Feed Make-Up



BENTUBE EVAPORATORS

EXAMPLES OF G-R PIONEERING

Coil-type Water Heaters
Stationary Make-up Evaporators
Scale-shedding Evaporators
Finned-tube Exchangers
Exchangers for Dirty Fluids
Scale-shedding Coolers and Condensers

SUSTAINED CAPACITY . . . without laborious hand cleaning . . . is maintained in G-R Bentube Evaporators by their thermal scale shedding feature.

SUSTAINED PURITY is assured by experienced design for proper balancing of disengaging area . . . headroom . . . vapor velocity . . . and other vital factors.

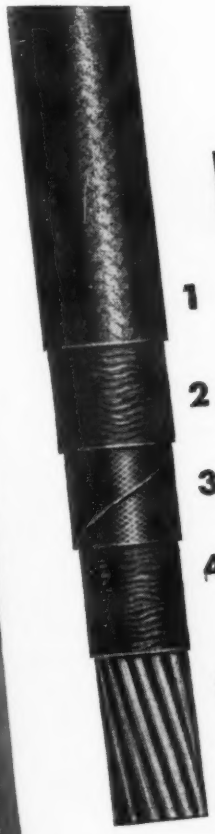
G-R BENTUBE EVAPORATORS have many additional advantages . . . rugged construction . . . readily accessible joints . . . efficient vapor separators . . . easy withdrawal of tube bundle.

These typical design features make G-R Evaporators of all types widely preferred . . . as evidenced by more than 3000 stationary and marine installations.

THE GRISCOM-RUSSELL CO. 285 MADISON AVE. NEW YORK 17, N. Y.

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus



ROCKBESTOS A.V.C.

1 POINTS THE WAY TO LONG WIRE LIFE

2 exposed to severe operating conditions

in lighting control and power circuits

3 Rockbestos A.V.C. Power Cable above, and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction:

4 1. A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

2. Outer felted asbestos wall, also impregnated with heat, flame and moisture resistant compounds, serves as an effective barrier against high ambient temperatures and flame.

5 3. Lubricated varnish cambric for high dielectric strength and added moisture resistance, protected from heat, flame and oxidation between two impregnated asbestos walls.

4. Felted asbestos insulation, impregnated with heat-, flame-, and moisture-resisting compounds, withstands conductor heating overloads and won't dry out, bake brittle or burn.

5. The conductor is perfectly and permanently centered in helically applied insulation.

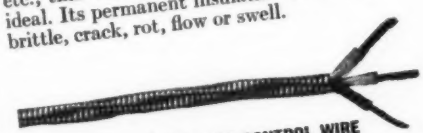
One of 122 different wires and cables developed for severe operating conditions by Rockbestos.

WON'T bake brittle, bloom, burn or rot.
RESISTS moisture, oil, grease and fumes.

ROCKBESTOS 600 VOLT A.V.C. BOILER ROOM WIRE
(Underwriters' Type AVA)

Sizes No. 18 to 4/0 AWG. This construction for sizes 18 to 8, sizes 6 to 4/0 have another wall of felted asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A.V.C. construction is ideal. Its permanent insulation will not bake brittle, crack, rot, flow or swell.



ROCKBESTOS THERMOSTAT CONTROL WIRE

Sizes No. 14, 16 and 18 AWG in two to six conductors with .012⅝", or .025" or (for 115 volt service) .031" of felted asbestos insulation and steel armor.

A multi-conductor control wire for low voltage intercommunicating, signal, and temperature control systems. Its lifetime heatproof and fireproof insulation and rugged steel armor will give you troubleproof circuits.

ROCKBESTOS 600 VOLT A.V.C. CONTROL CABLE

In one to 19 conductors. Standard stranding AWG No. 12—19/26 and No. 9—19/22. Other strandings furnished.

Designed for use under conditions too severe for control cables with other types of insulation which deteriorate rapidly when exposed to high temperatures. Operates without failure under the attack of heat, oil, grease or corrosive fumes and may be installed in conduit as it has ample moisture resistance.

Looking for a wire with a tough enough insulation to give years of trouble-free service in hot locations? Around forging presses, soaking pits, steam tunnels, lehrs, kilns, hot strip mills? In locations where heat, moisture, grease, fumes, etc. are playing hob with your present wires? Then investigate Rockbestos A.V.C.

Designed specifically for operation under severe conditions and in "hot-spot" locations, these Rockbestos A.V.C. wires, cables and cords have a permanent asbestos insulation that stands up where other wires fail. The naturally heatproof asbestos insulation, impregnated with heat-, flame-, and moisture-resisting compounds, withstands conductor heating overloads. It won't bake brittle, dry out, flow, rot or crack under heat and resists oil, grease and corrosive fumes.

Get trouble-free long wire life in your circuits by installing Rockbestos A.V.C. 122 constructions give you a wide range of choice to meet specific requirements. When ordering or inquiring, please furnish CMP allotment number or symbol, and certification. For complete information and samples, write nearest branch office or:

Rockbestos Products Corporation, 951 Nicoll St., New Haven 4, Conn.

FOR VICTORY—BUY WAR BONDS

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, OREGON.

TIME RESULTS ARE THE TRUE TEST OF POWER PIPING

Over a period of 36 years Navco has designed, fabricated and installed hundreds of Central Station and Industrial Piping Systems.

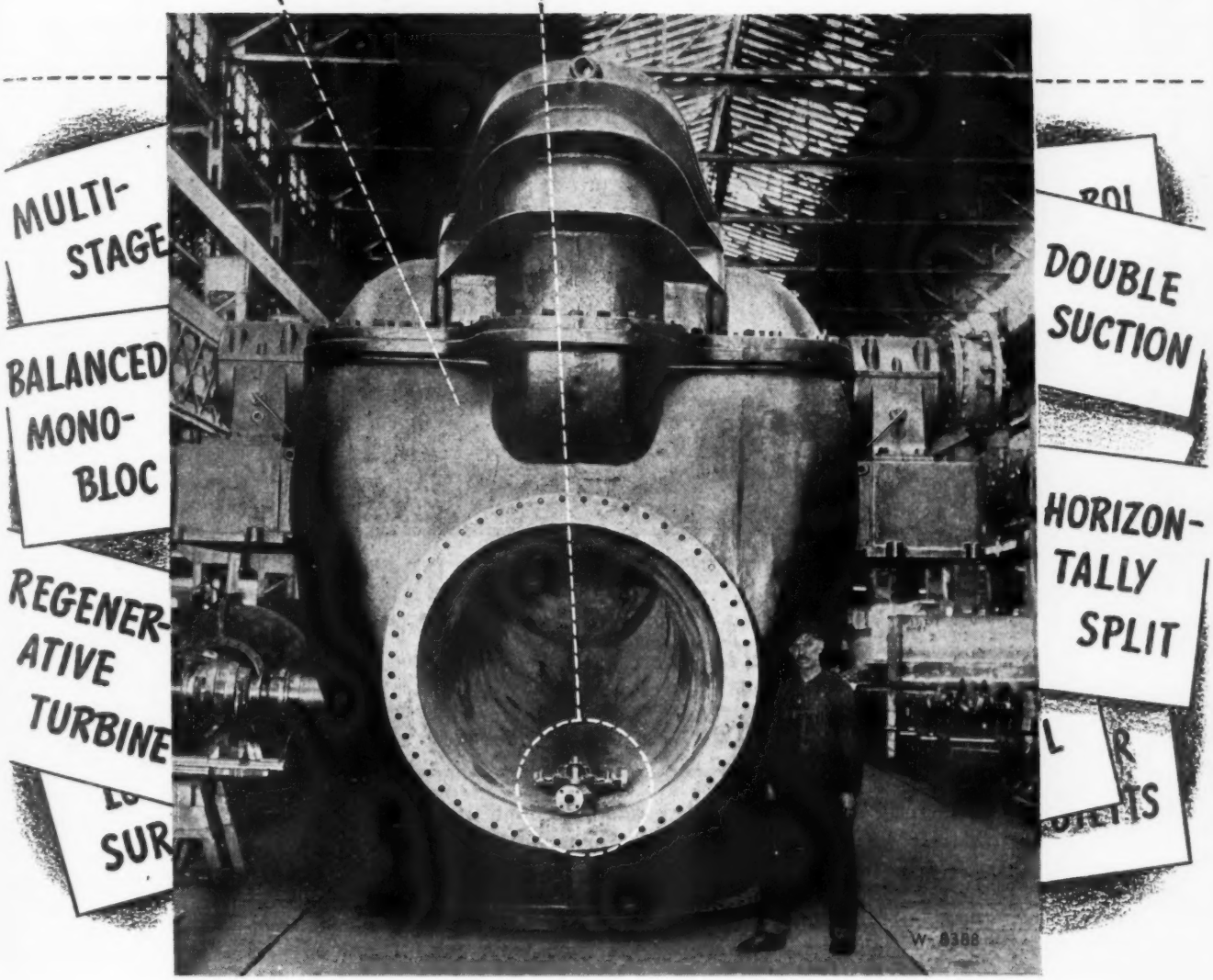
Navco quality in workmanship and design is evidenced by the fact that we have never in all this time completed a project that has not proven satisfactory in every way.

The time test has proven Navco installations to be superior.

For your next piping job consult Navco.

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

FROM GIANT TO MIDGET . . *Worthington builds 'em all*



The giant 66" Worthington centrifugal pump, holding the midget of the family in its massive discharge, well illustrates the complete scope of Worthington's line of standard centrifugal pumps available for your needs.

This particular big Volute Type LC pumps 135,000 g.p.m., more than 1500 times as much as the little Type R of similar design.

But, big or small, *all* Worthington standard centrifugal pumps share these two reasons for success:

1. The dependability and fitness for their service built into them by the world's largest pump manufacturer.
2. The progressive design features and high quality necessarily maintained by a firm which, like Worthington, also manufactures all kinds of specially engineered centrifugal process pumps for all industries.

WORTHINGTON *BEHIND THE NAME*

MEMBER

CP4-11

WORLD'S LARGEST MANUFACTURER OF PUMPS

STEAM | POWER | ROTARY | TURBINE WELL | CENTRIFUGAL

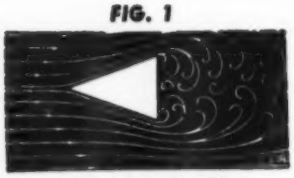
WORTHINGTON PUMP AND MACHINERY CORPORATION, HARRISON, N. J.

HOLDS THE PRESSURE SETTING VERY *Accurately . .*

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVES

THE "Type 1000" Valve gives users absolute control of pressures. The reduced pressure is held constant regardless of variations in the initial pressure or variations in demand.

FIG. 1



YOU DON'T GET THIS TURBULENCE

•

FIG. 2

YOU GET THIS STREAMLINED FLOW

•

This operating feature eliminates all chance of changes occurring in the processing or of damage to product.

When there is peak demand to be met, your "1000" Valve is easily able to do it, holding the pressure constant at the same time.

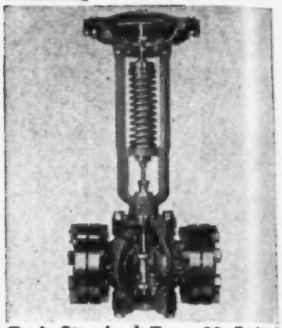
There is no downstream turbulence in your "1000" Valve. (See Fig. 1). The flow of steam, air, oil, etc. is streamlined (see Fig. 2) for straight flow through the delivery passage and jet. All of the process of pressure reduction occurs where the valve throttles flow and not on the downstream side of the valve. That is one of the feature results of streamlining. Therefore, there is no downstream turbulence and you have close delivery pressure control at all times.

Write for Bulletin "1000"

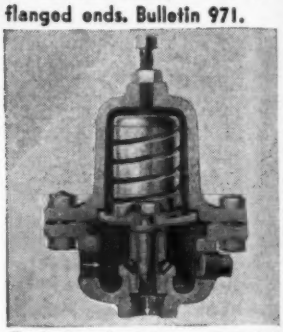
CASH STANDARD CONTROLS VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

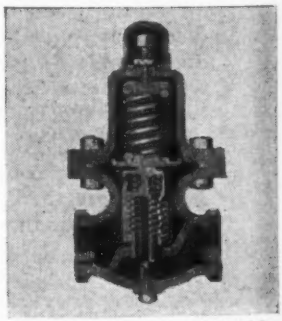
OTHER VALVES *from the* CASH STANDARD LINE



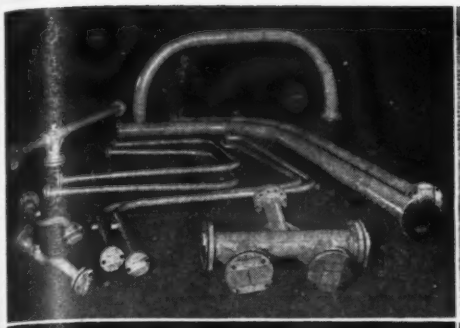
Cash Standard Type 33 Relief Valve; in various metals to handle nearly all fluids. Has Roller guides on valve spindle; also roller bearing to take care of spring torsion. Sizes ½" to 3" screwed ends; 1" to 12" flanged ends. Bulletin 971.



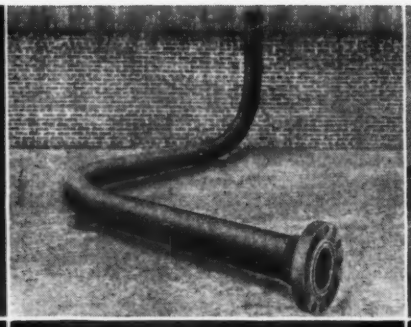
Cash Standard Type Q Relief Valve has side inlet, bottom outlet. Popular for pump by-pass use. Sizes ½" to 2" screwed ends. Relief pressures up to 350 lbs., temperatures up to 500°F. Bulletin 943.



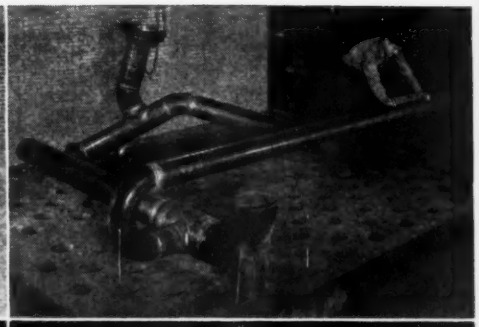
Cash Standard Type 4190 Valve for relief (bypass) use; holds constant valve inlet pressure regardless of changes in load or outlet pressure. Multiport—large capacity. Iron or bronze bodies; iron or bronze trim. Sizes ½" to 2" screwed ends; 2" to 6" flanged ends. Bulletin 952.



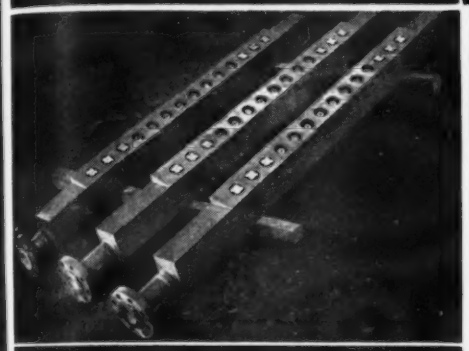
CHROME MOLYBDENUM



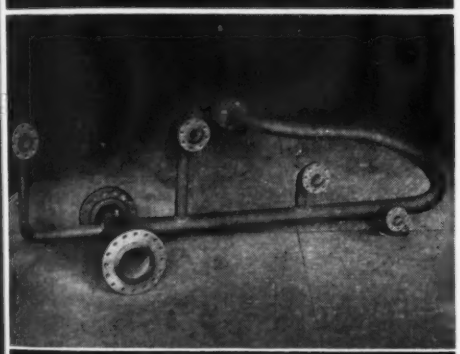
CARBON MOLYBDENUM



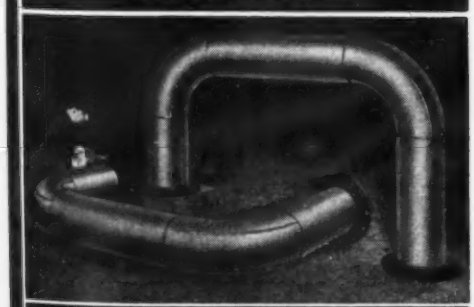
CARBON STEEL



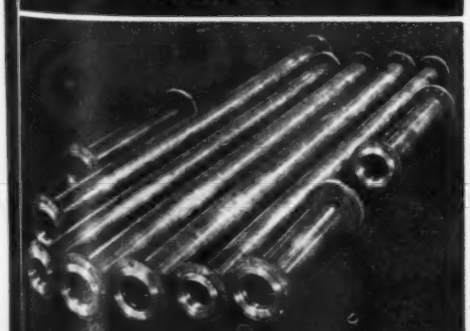
FORGED STEEL



WROUGHT IRON



STAINLESS



COPPER

Prerequisites for Efficient Piping Systems

- **SELECTION OF PROPER MATERIALS**
- **CORRECT FABRICATING TECHNIQUE**
- **APPROVED ERECTION METHODS**

FOR the correct fabrication of piping, varying techniques must be employed for different metals. Our more than forty years' successful experience in fabricating qualifies us to make helpful recommendations regarding the type of material best suited for your piping applications. This knowledge, coupled with complete facilities for correctly fabricating and installing single units or erecting complete assemblies assures fulfillment of your every piping requirement.

If you are planning alterations, improvements, replacements, or complete systems for central stations, paper mills, industrial and chemical plants, or other process industries, contact our nearest representative or write our Engineering Department direct. They will gladly make recommendations without obligation.

Do More Than Before—Buy EXTRA War Bonds

Pittsburgh Piping AND EQUIPMENT COMPANY

10 Forty-Third Street—Pittsburgh, Penna.

Woolworth Building, New York
Occidental Building, Indianapolis
Book Tower, Detroit
Peoples Gas Building, Chicago
Public Square Building, Cleveland
10 High Street, Boston
525 Market Street, San Francisco

Philadelphia

AIRKOOLED

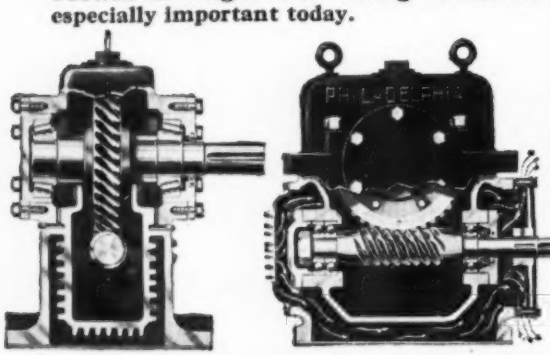
Worm Gear Speed Reducer

MORE LOAD CAPACITY
MORE COMPACT
Less Weight • Less Space

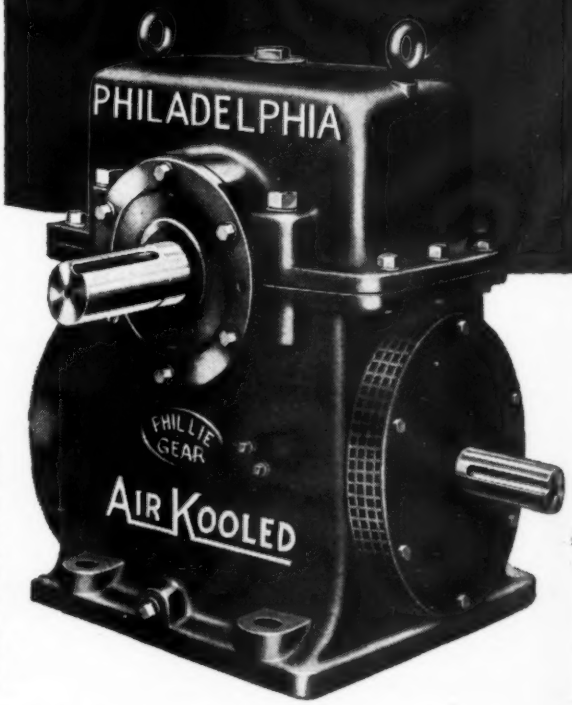
The New Philadelphia AirKooled Worm Gear Speed Reducer offers considerably greater horsepower ratings than the standard heavy duty type unit for worm speeds of 580 to 1750 RPM. At 1750 RPM, the ratings are approximately doubled at all ratios.

Horsepower ratings of standard worm gear units at higher worm speeds are limited due to the rise in temperature of the oil bath. The AirKooled unit dissipates this heat by drawing cooling air through the double walled ribbed housing with a suction fan mounted on the worm shaft.

At 1750 RPM, where the rating advantage is greatest, the AirKooled unit will be about two sizes smaller than a standard unit of the same capacity, resulting in a great saving in space and approximately a 40 percent reduction in weight. This saving in critical materials is especially important today.



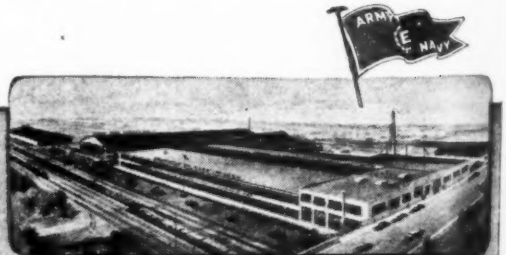
Sectional Views showing double walled construction, direction of air circulation and fan mounted on worm shaft.



Send for Bulletin 250 . . . on your Business Letterhead

Philadelphia GEAR WORKS INCORPORATED

ERIE AVE. AND G ST., PHILADELPHIA 34, PA. NEW YORK • PITTSBURGH • CHICAGO



Industrial Gears and Speed Reducers
LimiTorque Valve Controls

WHAT

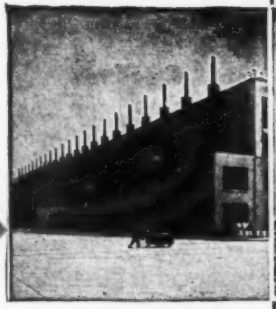
EXHAUST AND INTAKE SILENCERS

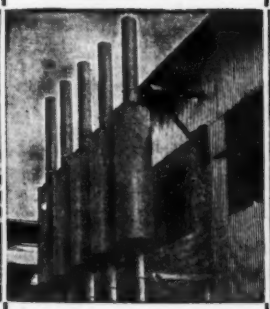
SPARK ARRESTOR SILENCERS

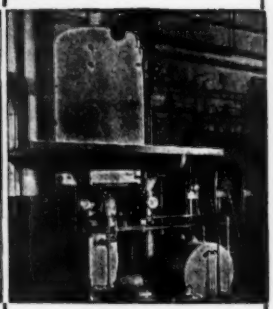
STEAM BLOW-OFF SILENCERS

HEAT RECOVERY SILENCERS

WHERE







WHEN

● These Maxim Silencers are designed to silence the exhaust or intake of internal combustion engines, steam engine exhausts, air compressor intakes, vacuum pump discharge and the intake or discharge of blowers of the positive pressure type. Wide choice of models to fit varying space and silencing requirements.

● Maxim Spark Arrestor Silencers effectively silence exhaust noise and in addition provide for 100% trapping of all sparks and embers which might come from the exhaust. Of obvious value in marine use, these Spark Arrestors are also applicable to industrial use where a fire hazard exists.

● These silencers were developed for use on installations involving the discharge of high velocity steam, air or gas to atmosphere. Used for steam blow-off, safety valve discharges, etc. Silencers shown above installed on high velocity steam exhaust have a total capacity of 135,000 lbs. per hour.

● Maxim Heat Recovery Silencers combine efficient silencing of engine exhaust with spark arresting (where necessary) and with the recovery of waste exhaust heat to produce steam or hot water. Highly efficient heat transfer . . . automatic controls . . . may be run wet or dry.

HOW

BULLETINS: D125, D127, D101, D37, D16.

BULLETINS: D105 and D33.

BULLETIN: D111.

BULLETINS: WH100, WH101 and WH103.

THE MAXIM SILENCER CO. • 92 Homestead Ave., Hartford 5, Conn.

ARMY E NAVY

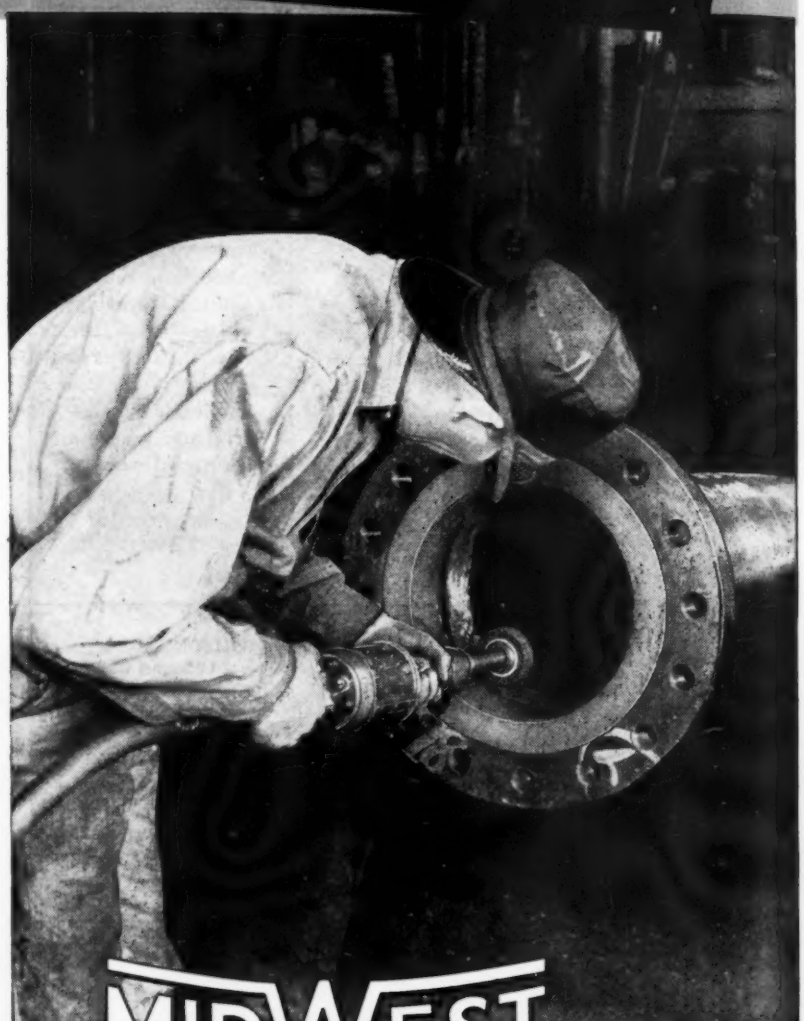
MAXIM

THOROUGH CLEANING

...another advantage of

MIDWEST

PRE-FABRICATED PIPING



Piping subassemblies that are pre-fabricated by Midwest are thoroughly cleaned before leaving our various plants. All scale, dirt and other accumulated impurities that otherwise would cause serious damage to valves, turbine blading, etc. are removed.

You do not have to waste time in cleaning Midwest Pre-Fabricated Piping . . . it is delivered ready to erect. The careful checking in our shops to make sure dimensions and alignment are correct . . . the searching inspection and shop testing . . . are other important time-saving advantages of Piping by Midwest.

• • •

Midwest Piping Service can be used to advantage whenever you need piping . . . whether a simple pipe bend or a complex high pressure piping job. Three modern fabricating plants are strategically located to serve you . . . and an experienced Erecting Division will take full responsibility for a complete piping installation.

MIDWEST

PIPING & SUPPLY COMPANY, INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Plants: St. Louis, Passaic (N. J.) and Los Angeles

Sales Offices: Chicago—645 Marquette Bldg. • Houston—329 Shell Bldg. • Los Angeles—329 Anderson St. • New York—(Eastern Division) 30 Church St. • Tulsa—535 Mayo Bldg.

PISTON RINGS GET A *Good* "BREAK"

SOLNUS OILS

End Hard Carbon and Stuck Rings . . . Reduce Repairs

Broken piston rings were a common occurrence in a municipal power plant equipped with 300 H.P. 4-cylinder, 210 H.P. 3-cylinder and 120 H.P. 2-cylinder Fairbanks-Morse diesel engines. The rings had to be broken to be freed every time the engines were cleaned . . . until one day they got a good "break." Here's how it happened.

Shutdowns 2 or 3 times a year for cleaning were necessary with the lubricating oil they were using. These shutdowns always disclosed the top rings stuck with hard carbon deposits — so badly stuck they were often broken while being removed. Production delays were too frequent . . . maintenance costs excessive. A Sun Oil Engineer suggested that the trouble was incorrect lubrication, and recommended low-carbon Solnus Oils.

Now only once a year they shut down the engines for cleaning . . . and then never find any hard carbon, never any stuck rings. They are always free and easily removed. Power interruptions have been reduced . . . maintenance time, labor and money saved.

Save and Serve with Solnus Oils. These oils that are low in carbon content, durable, wholly distilled, and neutral in acidity can provide lubrication for your diesels that will save you time . . . equipment . . . labor, too. Sun has a complete "Save and Serve" Plan including free lubrication booklets, charts, posters, bulletins, etc., which is yours without cost or obligation. . . . Write for descriptive folder.

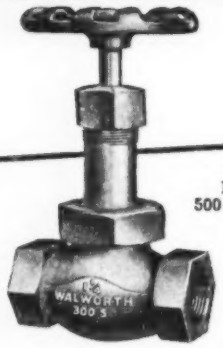
SUN OIL COMPANY • Philadelphia 3, Pa.

Sponsors of the Sunoco News Voice of the Air — Lowell Thomas

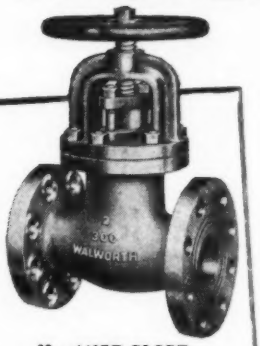
SUN INDUSTRIAL PRODUCTS

HELPING INDUSTRY HELP AMERICA

WALWORTH BRONZE VALVES

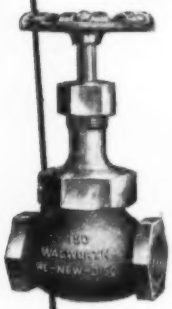


No. 225P GLOBE,
500 Brinell Seat and Disc



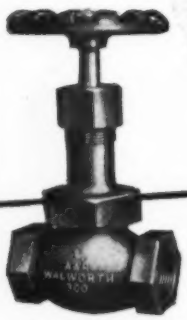
No. 448PF GLOBE,
Marine Service Valve.

A Complete line to choose from

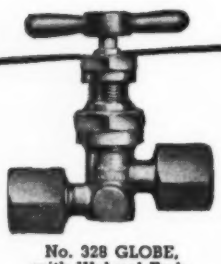


No. 95 GLOBE,
Re-new Disc

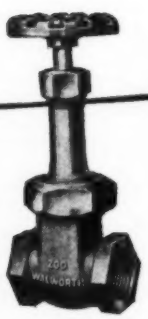
No. 420 SWING CHECK,
Regrinding Valve



No. 256 GLOBE,
A.A.R. Locomotive Valve



No. 328 GLOBE,
with Walseal Ends
3000 lb. O.W.G.



No. 29 GATE,
Double Disc-Taper Seat

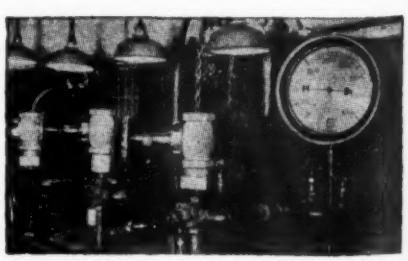
No. 11 GATE,
One-Piece Wedge

No. 1736 BRONZE,
Lubricated Plug Valve

Walworth's *complete line* of bronze valves, a number of which are illustrated above, includes types designed to fit every service where bronze valves are required. Strict laboratory supervision of the physical, chemical, and metallurgical properties of the materials entering into all Walworth products is supplemented by continuous inspection of the manufacturing operations, both as to accuracy and quality of finish, and by rigid final inspection and testing of each individual product.

Walworth manufactures a complete line of valves and fittings in steel and iron, as well as bronze. Cast iron pipe and three types of pipe wrenches are also made. For full details on Walworth products write, on your company letterhead, for a free copy of Walworth Catalog 42.

Testing Seats of Bronze Valves



Assembled bronze valves are subjected to test under pressure—either air-under-water, steam or hydraulic. The hydraulic seat test is shown here. Walworth Quality Bronze Valves undergo a hydrostatic shell test of three times their rated working steam pressures.

BOSTON WORKS
KEWANEE WORKS

WALWORTH
valves AND fittings
60 EAST 42nd ST., NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

IT TAKES A *Long Time* TO DESIGN A "*Buffalo*" PUMP

★ Sometimes we think it takes too long. But then we're reminded that when the engineering department finally says "go ahead and sell 'em," we seldom have any difficulty in "keeping 'em sold."

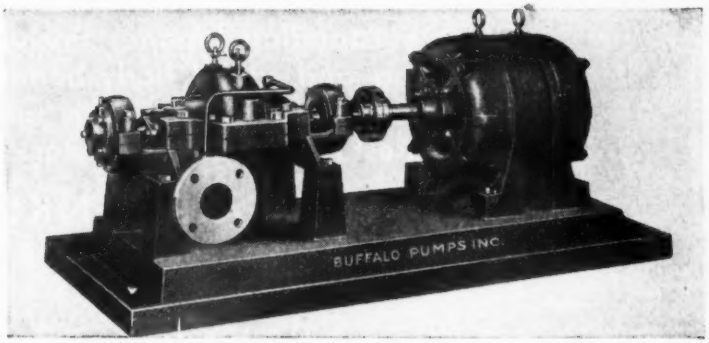
Pumps in the test room are no different than pumps on the job. If you make your testing severe enough—you can detect all their faults and weaknesses BEFORE you offer them to your customers. And if you redesign to remove those weaknesses, it takes time. When the job is finished, tho, and providing your basic design is right, you'll have a pump that PERFORMS on the job like those shown here! And, as has been our experience, users will come back for more!

If you haven't used Buffalo Pumps, we suggest that you plan to try one.

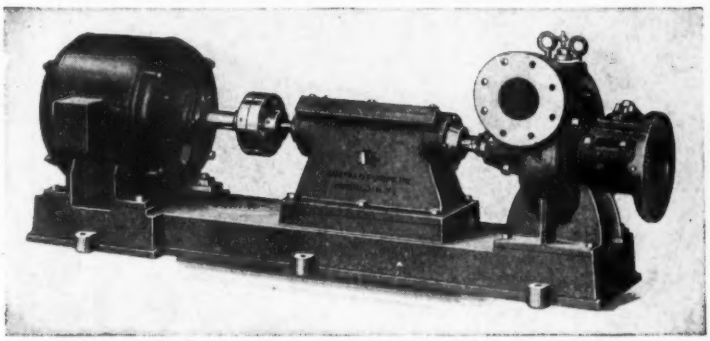
BUFFALO PUMPS Inc.

488 Broadway Buffalo, N. Y.

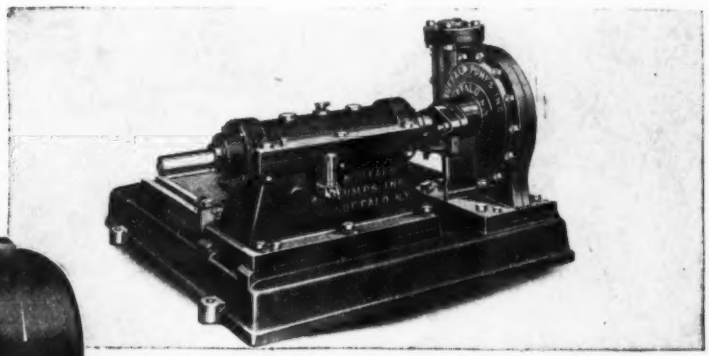
Canada Pumps, Ltd., Kitchener, Ont.



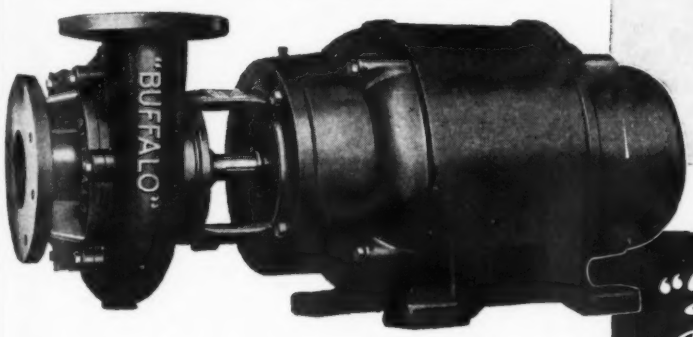
Buffalo 2-stage Double Suction "RR" Boiler Feed Pump



Full Ball Bearing Diagonally Split Shell Paper Stock Pump



Buffalo Full Ball Bearing Lead Pump arranged for Texrope Drive



Buffalo Close Coupled Single Suction Pump

"Buffalo" CENTRIFUGAL PUMPS

Prevent Lengthy Shut-Downs for Valve Repairs

Fairbanks Renewable Composition Disc Valves, with quickly replaceable slip-on disc holders, prevent lengthy shut-downs for valve repairs. The complete disc assembly can be easily and quickly replaced and service resumed without removing the valve from the line.

Other outstanding features, including Protected Top Seat for repacking and radial body-bonnet joint, are fully described in Catalog No. 42. Write today for your copy and the name of the nearest Fairbanks distributor.

THE FAIRBANKS COMPANY

393 LAFAYETTE STREET NEW YORK 3, N. Y.

BOSTON, MASS. PITTSBURGH, PA.

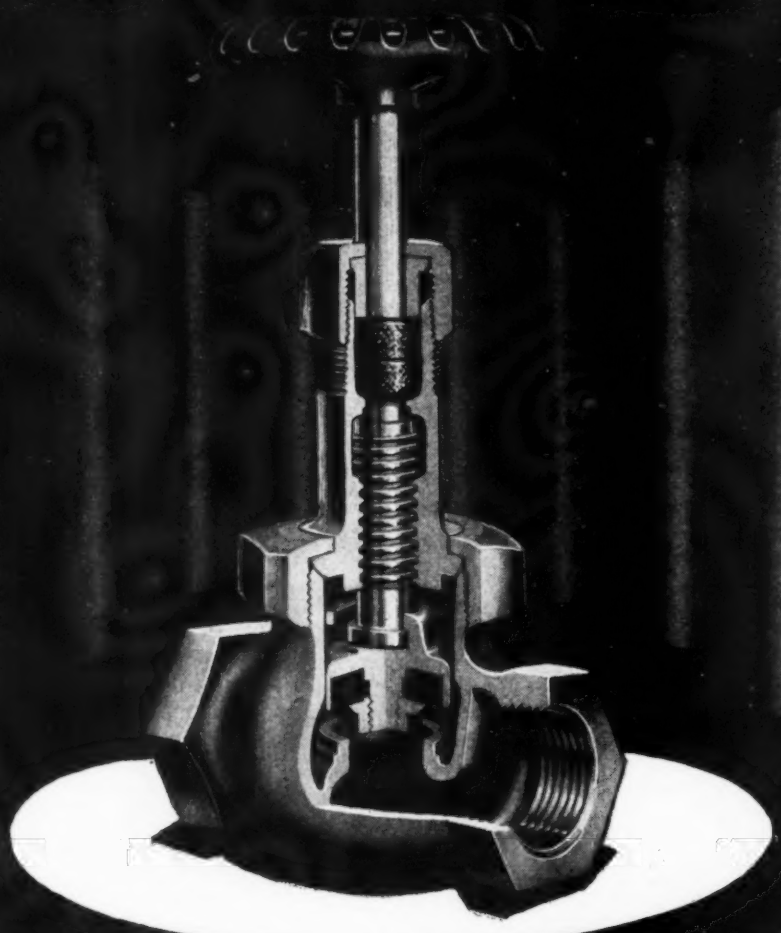


Fig. U-01

FAIRBANKS RENEWABLE VALVES

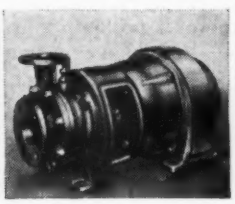
We've primed our pumps for your post war world

15 or 15,000 gallons per minute—Lombard Pumps now serve the Nation on land and sea. Tomorrow—that splendid tomorrow of America's future—they will be at the service of American shipping, industry, agriculture and science.

Lombard Pumps, like Lombard Governors, Relief Valves and Variable Speed Drives, will proudly bear the high standards of quality that have earned for Lombard skill their third Navy "E"—for EXCELLENCE.

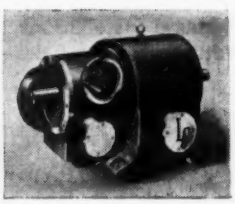
Write for engineering bulletins on Pumps and other products in which you are interested.

Relief Valve



Centrifugal Pump

Water Wheel Governor



Variable Speed Drive

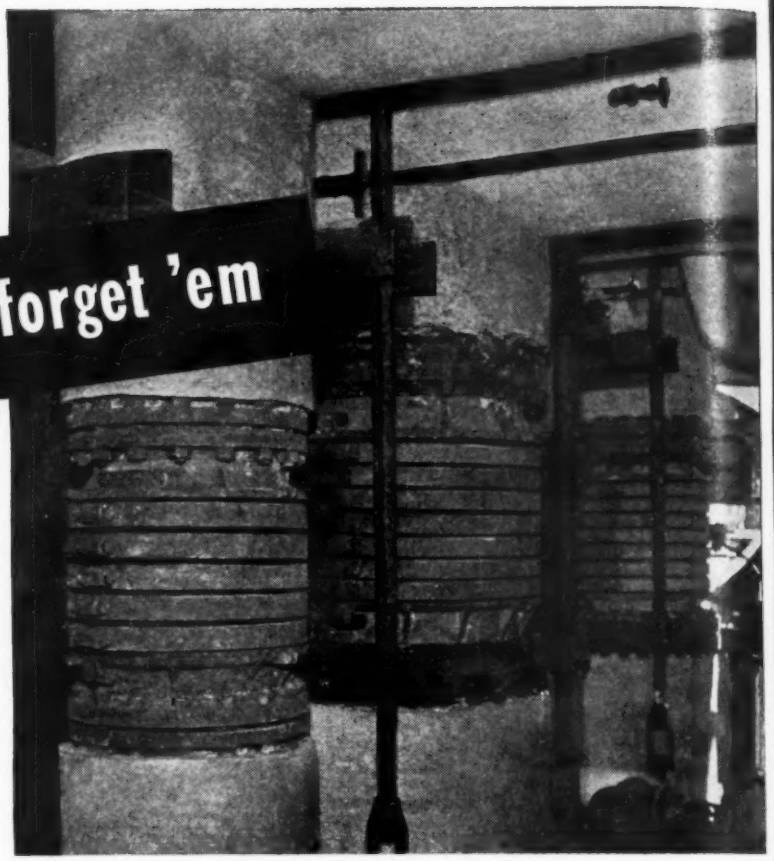
LOOK TO LG WHEN YOU LOOK TO THE FUTURE

LOMBARD GOVERNOR CORPORATION

Sales Office • 60 E 42nd St. • New York

ASHLAND • MASSACHUSETTS

Install 'em and forget 'em



Badger Self-equalizing Corrugated Expansion Joints installed in a Houdry Catalytic Cracking Unit of Sun Oil Company's new refinery at Marcus Hook, Pa.

These* PACKLESS *and

SELF-EQUALIZING

expansion joints can

take care of themselves

YES, Badger Corrugated Expansion Joints make life pretty dull for the packing-maintenance crew . . . because they haven't, and don't need, any packing whatsoever. They're formed from a single piece of tubing. And, as you see above, they're so compact that they take up no more room than a comparable flanged fitting itself.

It's easy to see how these joints not only eliminate maintenance expense and conserve space, but they also, in underground installations, save costly expenditures for manholes and tunneling.

Directed Flexing

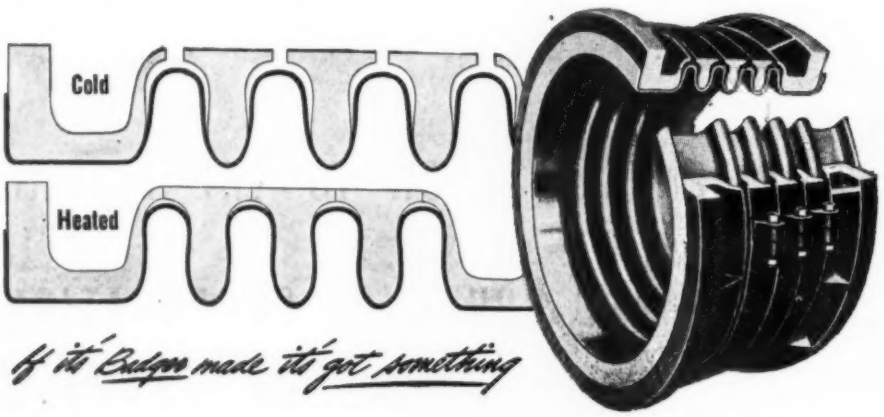
is another feature that lets you forget these superior joints once they're installed. First, to prevent normal stresses from localizing, *Badger corrugations have no "junctions," angles or straight sides.* They are formed in ALL-CURVE design—to distribute the stresses progressively and evenly.

As the joint compresses, the Badger ALL-CURVE equalizing rings *direct the further flexing movement.* The contours of the corrugations match those of the rings. The rings make sure there is no "piling up" of stresses in any one section or corrugation. Hence, no excessive strains or premature weakening! Greater dependability and longer life are a certainty.

There are no other expansion joints with these ALL-CURVE and DIRECTED-FLEXING features.

Made in Copper for normal pressures and temperatures; in Stainless Steel for higher pressures and temperatures—and where corrosion is a problem. Single and multiple corrugations—to take care of traverses ranging from a fraction of an inch upward. Also made in *non-equalizing* type for pressures and traverses that do not require the added protection of equalizing rings.

FREE BULLETINS: No. 100 on Self-equalizing; No. 200 on Non-equalizing.



If it's Badger made it's got something

Badger

PACKLESS CORRUGATED EXPANSION JOINTS

•

E. D. BADGER & SONS CO.
75 Pitts Street Boston 14, Mass.

AGENTS IN PRINCIPAL CITIES

Are You the Agent We Are Looking For ?

If you are an established Agent handling industrial equipment, including sales and service, and are desirous of adding a high-quality turbo-centrifugal boiler feed pump to your line, you may be the Agent we are looking for.

The Agent we want is located in one of the following States:

Colorado	**Ohio**	**Michigan**
Missouri	**Indiana**	**Georgia**
Illinois	**Tennessee**	**Pennsylvania**

He is wide-awake, aggressive, and well-known in the Industry. He is aware of the postwar potentialities in the territory he serves.

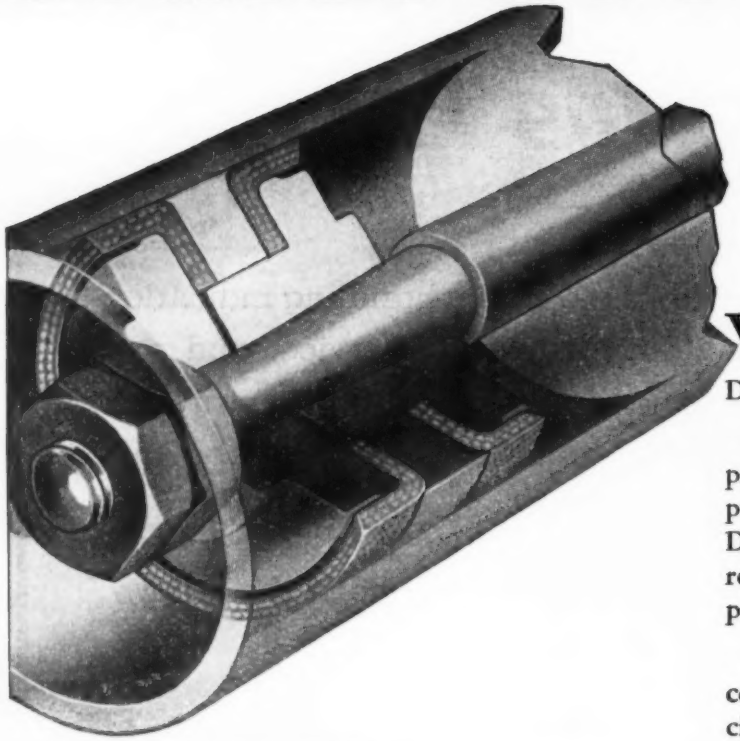
To such an Agent, we can offer an attractive, exclusive sales agency, with exceptional post-war possibilities.

In writing please include the territory you cover, the size of your organization, and the accounts handled at present.

ADDRESS YOUR REPLY TO: POWER

P. O. Box No. 713, 330 West 42nd Street, New York 18, N. Y.

DARCOVA PUMCUPS



Unique principle saves up to $100 per pump per year for thousands of pump users

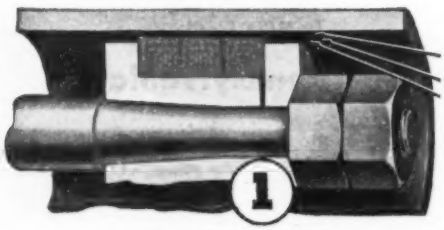
WHATEVER you pump—water, oil, gas, steam, alkalies, acids, or other liquids—Darcova can save you time and save you money.

Darcova is the original composition valve cup, proved by 35 years of service. As applied to pumps, it is known as the Darcova Pumcup. Darcova Pumcups are readily applied to any reciprocating pump by means of a simple, inexpensive adapter piston, illustrated above.

By employing the simple cup principle, Darcova increases pump capacity and pumping efficiency. On the pumping stroke, fluid pressure against the inside of the cup forces the sidewall out against the liner, creating a tight seal that prevents slippage past the piston. This tight seal also prevents lodgment of dirt or abrasive particles between cup and liner, and so reduces scoring and wear.

Just compare this efficient action with that of ordinary pump packing. And remember, too, that Darcova's unique composition stands up—not only against the frictional wear of millions of pump strokes, but against chemical action of all kinds, too.

No wonder thousands of Darcova customers are experiencing up to $100 saving per pump per year.

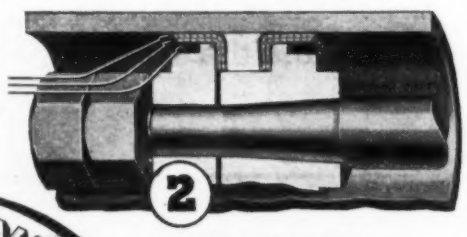


1 THE OLD WAY

From the minute ordinary packing is installed in your pumps, it begins to wear. Each piston stroke means increased clearance between packing and liner. Added clearance means more slippage—and more loss of efficiency—until finally efficiency drops so low that the pump must be repacked. Note also that friction load is the same on both load and return strokes.

2 THE DARCOVA WAY

With Darcova Pumcups, the cup principle insures constant pumping efficiency. Fluid pressure keeps the Pumcup sidewall in close contact with the liner, regardless of wear. There is minimum slippage. Furthermore, on change of stroke, pressure inside the Pumcup is released and load on return stroke reduced. This means fewer shutdowns and many hours of longer service.

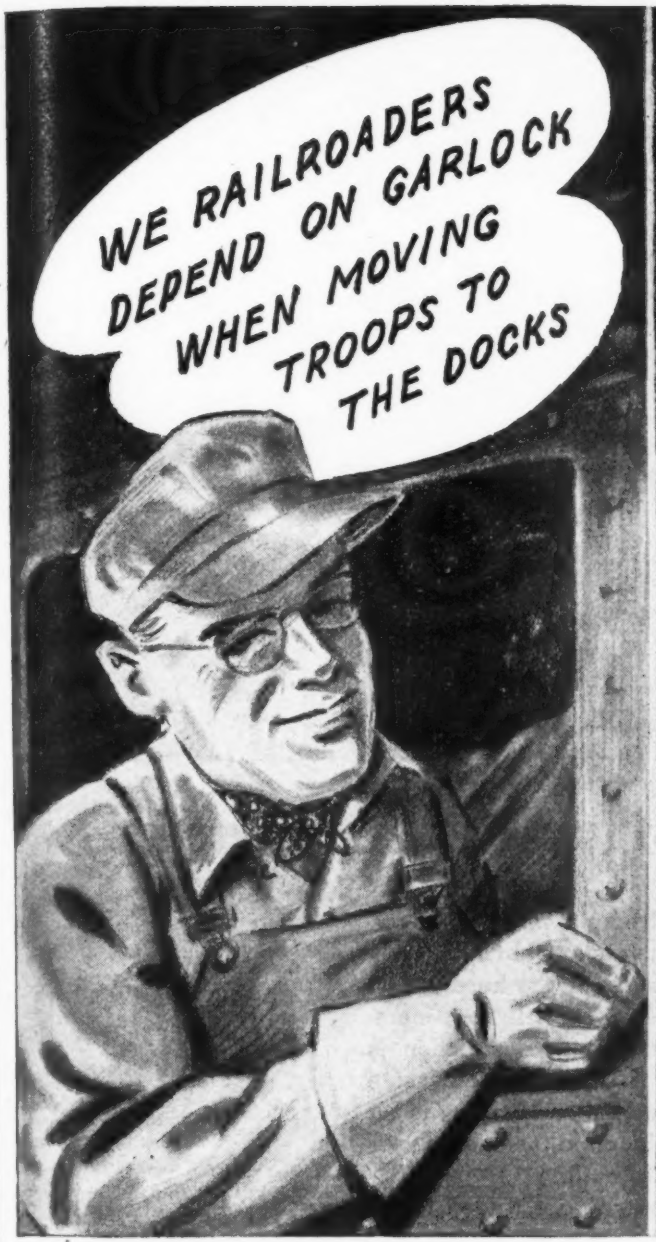


Let Us Survey Your Needs, FREE

Darcova Field Engineers can help you get more for your pumping dollar—just as they are helping others. Phone, wire or write us—or ask your supply store or industrial distributor—about the FREE Darcova Survey Plan and Service.

DARCOVA
THE ORIGINAL COMPOSITION CUP

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT, PA.



GARLOCK Chevron Packing is one of the many GARLOCK products being supplied in great quantity to the Armed Forces, the railroads and war industries. Chevron gives superior performance because of its exclusive hinge-like design and quality-controlled construction.

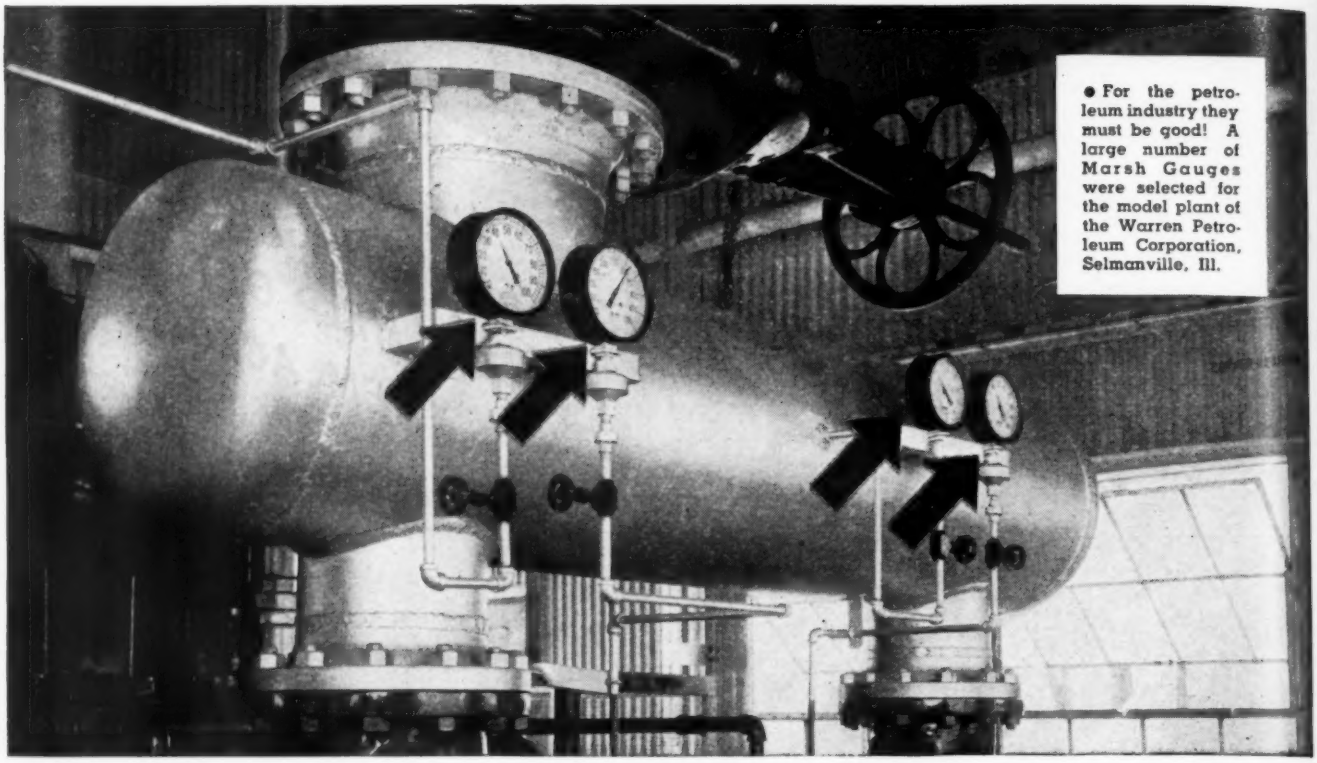
Garlock Packing Helps Keep Our Troops Moving Overseas

On land, on sea and in the air—GARLOCK packings, gaskets and KLOZURE oil seals are giving dependable service to help keep our troops and supplies moving fast—for Victory.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

In Canada: The Garlock Packing Company of Canada Ltd., Montreal, Que.

GARLOCK



● For the petroleum industry they must be good! A large number of Marsh Gauges were selected for the model plant of the Warren Petroleum Corporation, Selmanville, Ill.

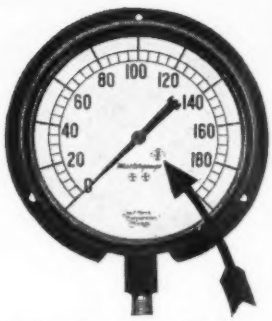
Who builds the best pressure gauges?

PERHAPS it wouldn't be fair for *us* to answer that question—but it *is* a fair question. It's the kind of question that bobs up in the mind of every man who buys, specifies or uses equipment of this kind. The answer to it is important to you, so we suggest a few ways in which you can sift it down to the *right* answer.

First of all, consider the fact that Jas. P. Marsh Corporation has been making gauges and similar instruments for more than 75 years. That could mean much or little, but everything being equal it should mean much. And the best way to find how much it means is to *examine* Marsh Gauges.

If you do, you will find that they always incorporate design and construction that adapts them to the job at hand—construction that could only have been taught in the hard school of experience. You will find, moreover, that this finer construction is not confined to the most expensive Marsh Gauges, but is common to all of them in relation to the services for which they are built.

But perhaps you don't need to examine the Marsh product. Perhaps you are on speaking terms with a Marsh Gauge, Dial Thermometer or Heating Specialty that has long since given you the answer to "Who builds the best?" in the plain language of lasting accuracy. If so, you know why we have no hesitancy in asking the question . . . and leaving the answer to the Marsh Product!



The Gauge with the "RECALIBRATOR"

Even the best gauge can be knocked out of adjustment—but if it's a Marsh, a twist of the "Recalibrator" screw restores its accuracy throughout its *entire* scale. This is the only basically sound way to correct a gauge that has been thrown out of adjustment. The advanced Marsh "Mastergauge" is illustrated above. There is a type of Marsh Gauge, Dial Thermometer or Recorder for practically any service.

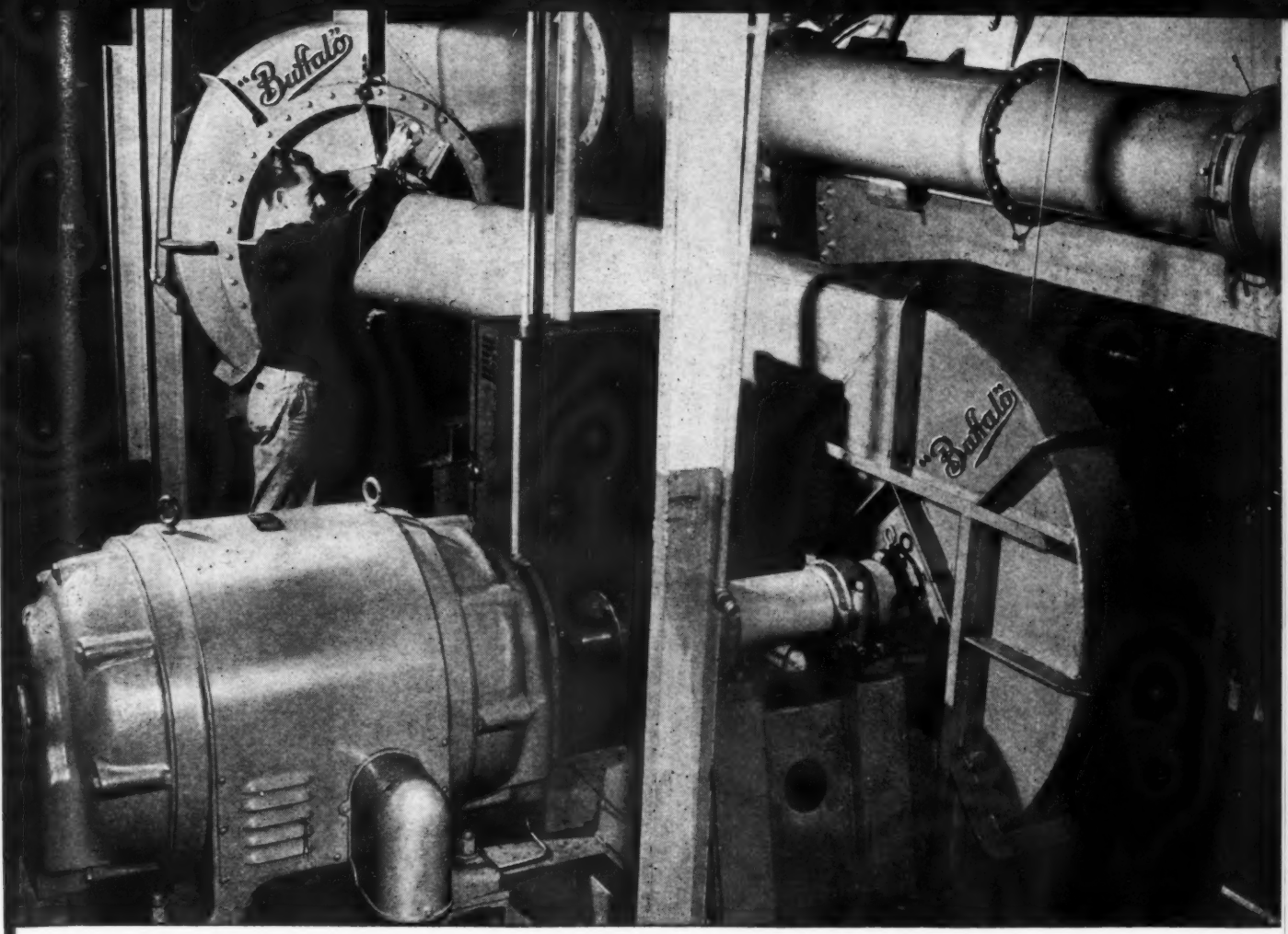
Marsh Instruments are available for essential uses.

JAS. P. MARSH CORP., 2075 Southport Ave., Chicago, Illinois

MARSH GAUGES

DIAL THERMOMETERS . . . RECORDERS . . . HEATING SPECIALTIES

The oldest manufacturer—the newest ideas



Two Buffalo blowers, part of an intricate set-up at the plant of an Airplane Manufacturer to duplicate stratosphere conditions in the testroom.

CONQUERING THE UNKNOWN

"Fan Engineering" is the air engineers reference on almost every industrial project built in U.S.A. in the past 30 years. Thousands of copies of this book are serving the contractors and operators of America's armament and munitions plants, and in allied plants as well.

"Fan Engineering" deals with theory and practice of handling air and gases mechanically. 740 pages bound in limp black fabricord. $4.00 postpaid in U.S.A.

In laboratories, in little shops, in big factories all over America, men are exploring the unknown. From pure research come developments which change the course of human destiny, and from the laboratories and test rooms of Industry come improved products and processes.

"Buffalo" fans and air conditioning equipment have played an important role in this scientific invasion of the unknown, for many years. Some of the aviation industry's earliest wind tunnels were "Buffalo" equipped, (as have been most of them since). In the earliest frozen food factories, Buffalo Fans circulated the icy air, and in the latest streamlined process for quick-freezing, "Buffalo" Axial-Flow Fans are used. Dehydration plants use hundreds of Buffalo Fans and heating coils. In the pilot plants for synthetic fibers, Buffalo fans and dehumidifiers helped work out the manufacturing techniques used today. Buffalo fans by the hundred are used in the synthetic rubber industry.

For every one of these established processes which have come into being as a result of research, there is today additional research to improve, to lower the cost, to expand.

Buffalo engineers, with more than sixty-six years of practical experience behind them, with very complete lines of fans, evaporative coolers, and air conditioning equipment to offer, are eager to develop new applications for this equipment. If you have a problem which concerns the movement or tempering of air or gas, Buffalo engineers can help you select the equipment which will give you the most efficient and economical results.

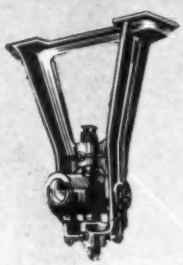
"Remember, when there's an air-handling or conditioning problem, let "Buffalo" supply the answer."

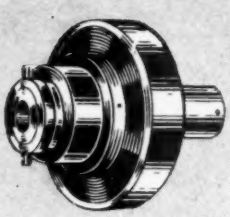
"Buffalo" "First For Fans"

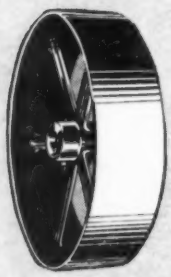
BUFFALO FORGE COMPANY

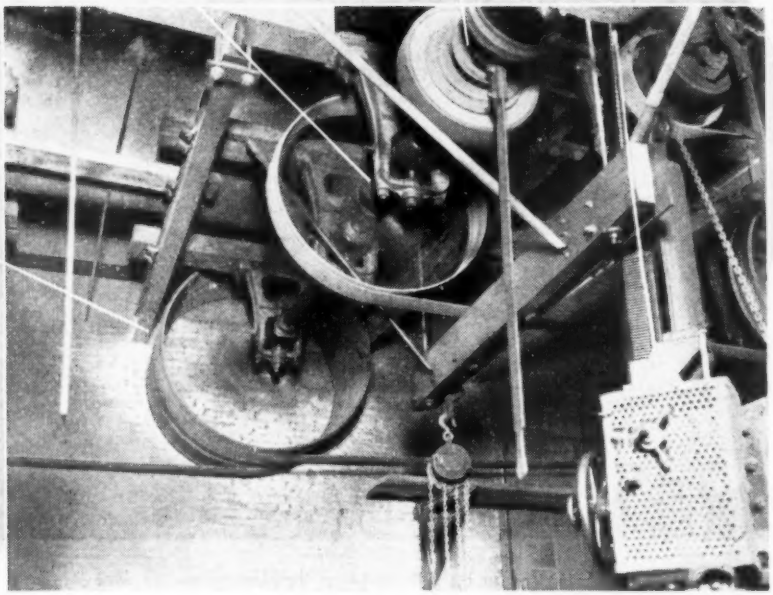
BUFFALO New York • BUFFALO PUMPS, INC. • THE GEO. L. SQUIER MFG. CO. CANADIAN BLOWER & FORGE CO. LTD. • CANADA PUMPS, LTD.

Buy WAR BOND









FITTING THE PRODUCT TO THE JOB . . . That's . . .

sound engineering—87 years of it—the reason so many plants have discovered that Wood's Power Transmission Equipment keeps machines producing at top efficiency.

Skillful design and proper application of selected materials carefully machined, are combined to assure efficient, dependable and trouble-free power transmission, over the long lifetime of Wood's products.

To secure top performance in modern group drives, direct connected drives or V-belt drives, specify Wood's planned Power Transmission equipment . . . it will help you to meet today's wartime production problems and tomorrow's conversion to peacetime operation.

Write us for more information, or see your local Wood's dealer.

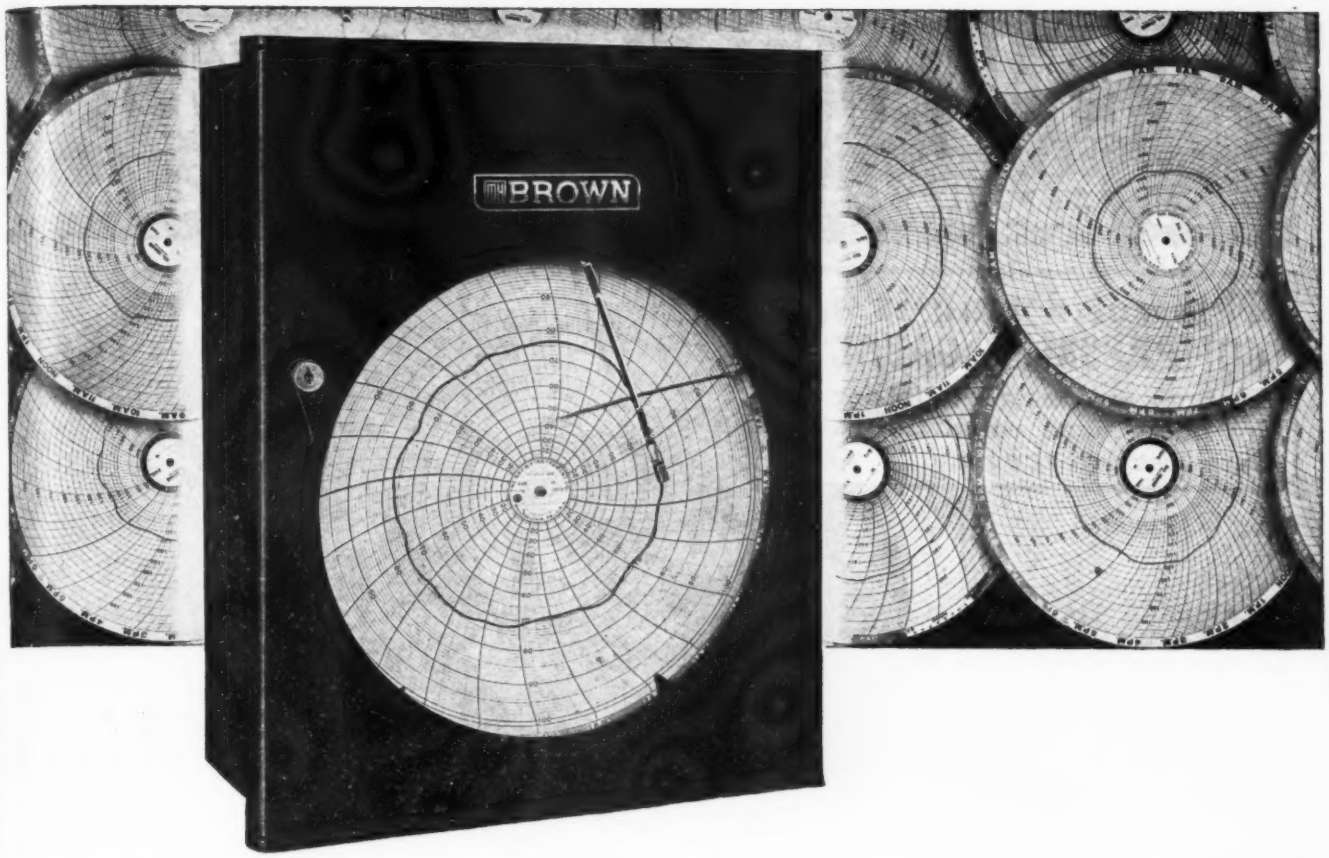
Wood's PLANNED POWER TRANSMISSION

The Wood's line of equipment for power transmission comprises bearings, collars, couplings, friction clutches, hangers, pillow blocks, pulleys and shafting for a variety of uses covering various industries, including cement mills, generators; paper mill, wood working and laundry machinery; compressors, mine fans, drill presses and for many other uses.

LONG LIFE LINE

T. B. WOOD'S SONS COMPANY, CHAMBERSBURG, PENNA.

BRANCHES: 387-391 ATLANTIC AVE., BOSTON, MASS. • 83 PLANE ST., NEWARK, N. J. • 425 FIRST AVE., PITTSBURGH, PA.



How Economical is your Economizer?

Where to Use Brown Thermometers

Measure and Record:

- Air Temperatures at preheaters
- Flue Gas Temperatures leaving boiler
- Gas Temperatures at preheaters
- Gas Temperatures at economizers
- Oil Temperatures at burners
- Water Temperature at boiler inlet
- Water Temperatures at economizer

AN economizer should live up to its name . . . that is, properly conserve heat energy of the boiler exit gases.

The more efficient the economizer, the lower your fuel bill will be. That the economizer is a means of reducing the cost of generating steam is well known to users of Brown Thermometers. Where they are installed, users have an accurate means of checking gas and water temperatures entering and leaving the economizer. The chart records enable them to attain maximum boiler operating efficiency.

Brown Recording Thermometers measure temperatures ranging from —100° to +1000° F. in ranges suitable for power plant practice. Instruments can be supplied in one, two or three pen models.

Brown Thermometers can be furnished with tubing as long as 200 feet. Brown Recording Pressure Gauges are available for operating pressures ranging from 30 inches vacuum to 10,000 lbs. per sq. in.

THE BROWN INSTRUMENT COMPANY, 4490 Wayne Avenue, Philadelphia, Pennsylvania, a division of MINNEAPOLIS-HONEYWELL REGULATOR COMPANY, Minneapolis, Minnesota. Offices in all principal cities. 119 Peter Street, Toronto, Canada—Wadsworth Road, Perivale, Middlesex, England—Nybrokajen 7, Stockholm, Sweden.

Instruments by **BROWN** *and Controls by*

MINNEAPOLIS-HONEYWELL

FLEXITALLIC C-G GASKETS
for High-Pressure Flanged Joints

This solid ring is a COMPRESSION GAUGE
Flanges are drawn together by bolt-turns until flange faces rest on the ring.

This is the SEALING MEMBER
— so designed that when flange faces are drawn to the ring, bonding load is right.

The outer, solid metal ring tells you how far to go when pulling down on the bolts. You don't have to calculate. Just pull to the ring and stop.

You don't have all the worry about the sealing member being properly centered. The ring fits the bolt circle and the bolts guide the sealing member to the right position. They hold it there while the joint is being assembled.

The sealing member is so made that it has density in exact relation to *your* pressure. When you pull the flanges down to the ring, you set up a gasket barrier that has ample strength for *your* conditions.

Ample strength? Precisely. The density of sealing metal is neither too great for the bolting nor too little to hold the confined fluid.

Adjusting Density of the Sealing Member

In the sectional view above, you see stacked metal looking like laminations. In the structure of the sealing member, this metal is a continuous spiral, from the first turn on the I.D. to the last turn on the O.D. The number of turns per unit of flange-width is variable. The number is of one order for pressures from 150 to 300 pounds, of another order for 400 pounds, and so on for standards up to 2500 pounds.

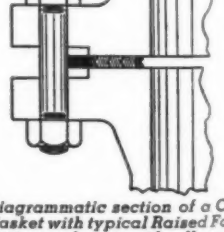
Density is modified also by winding metal turns together, leaving out the spacing material. Butted turns can be readily identified, in the sectional view, not only at the extremes but in between. These butted turns have great strength and their number and position can be selected in the light of pressure conditions.

"Flexitallic" Reg. U.S. Pat. Office

Representatives in Principal Cities

There's Something TO This Gasket Art

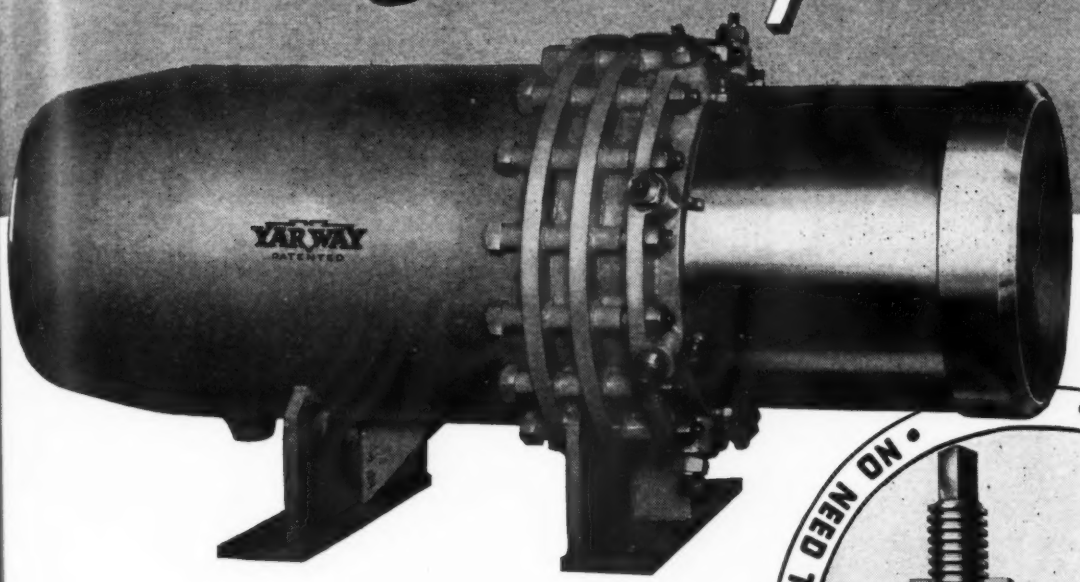
It seems a simple thing—this combination of a solid, gauge-ring and an inner, sealing member. It has the simplicity of saving your time. It is the simplest and easiest way for you to get a tight, lasting seal in a gasketed joint.



Diagrammatic section of a C-G Gasket with typical Raised Face fittings showing the flanges compressed to the thickness of the solid metal member.

FLEXITALLIC GASKET CO., 8th and Bailey Streets, Camden, N. J.
Originators of Spiral Wound Construction

Never Unpacked in Eight Years of Service



Years of experience with thousands of Yarway Gun-Pakt Expansion Joints have established the Yarway as the preference of leading industrials, utilities, institutions and government departments.

For they all have learned that this joint which is packed under full steam pressure and never needs to be unpacked—eliminates repacking shut-downs, saves a tremendous amount of time, trouble, money and hard labor under gruelling temperature conditions, normally required to keep slip-joints tight.

Why don't you investigate the Yarway Gun-Pakt Joint—called "the greatest expansion joint improvement of modern times."

Write for Catalog EJ-1909.

YARNALL-WARING COMPANY
100 Mermaid Ave. Phila. 18, Pa.

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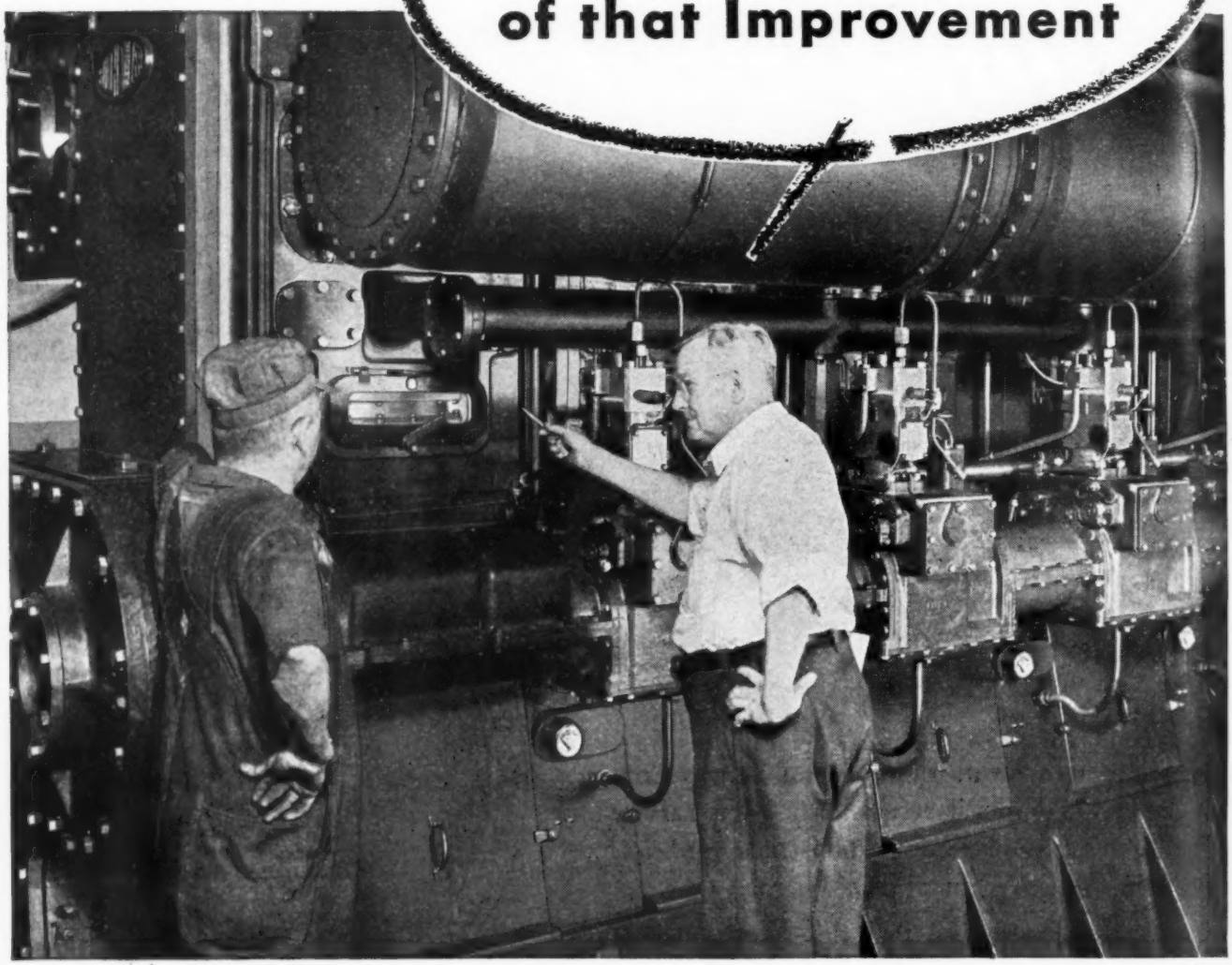

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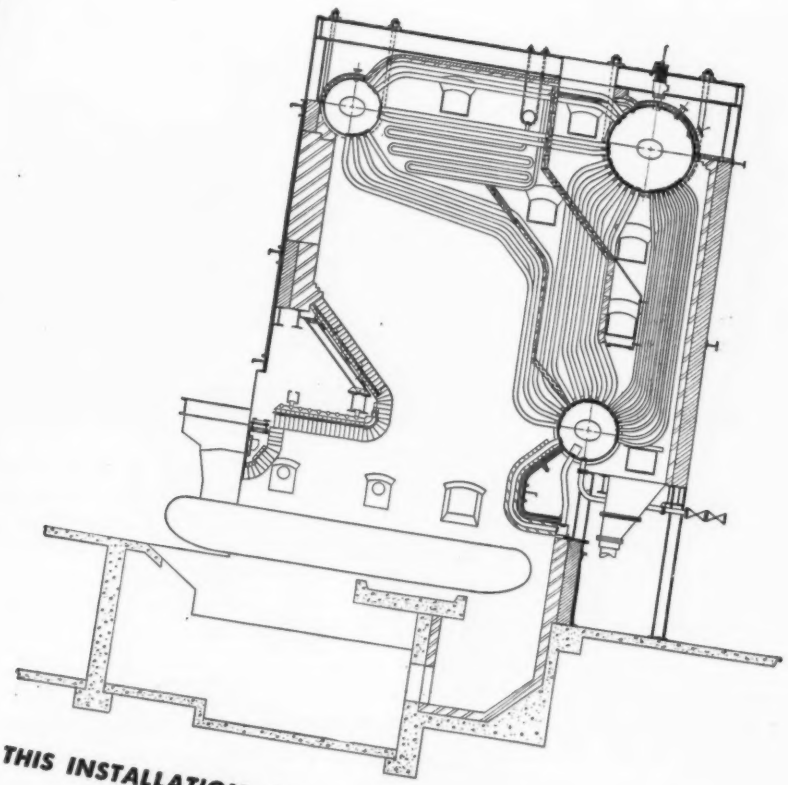

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FINAL STEAM TEMPERATURE . . . 650° F.

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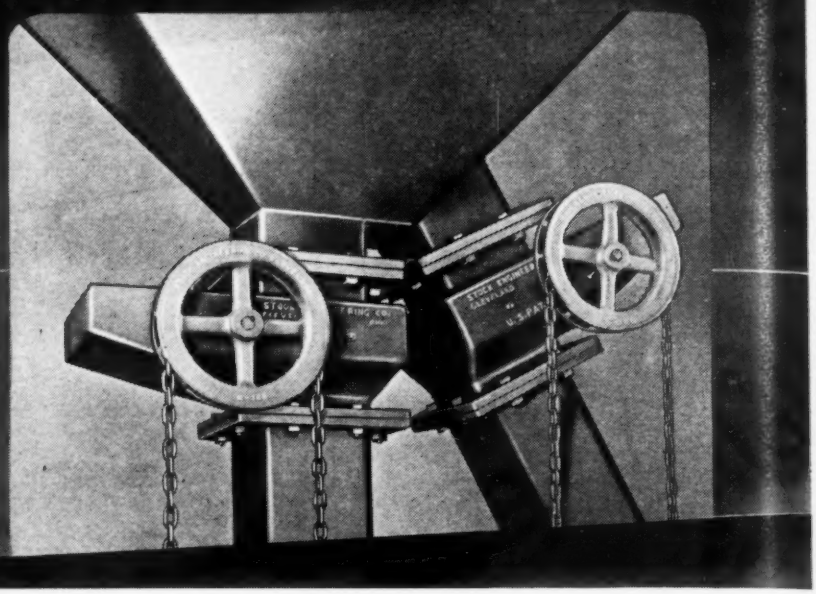

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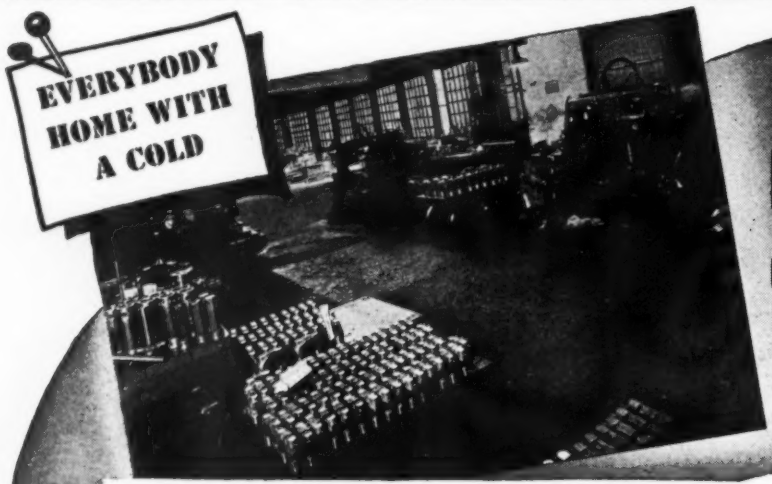

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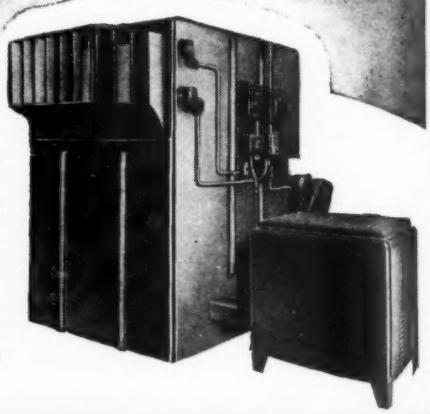

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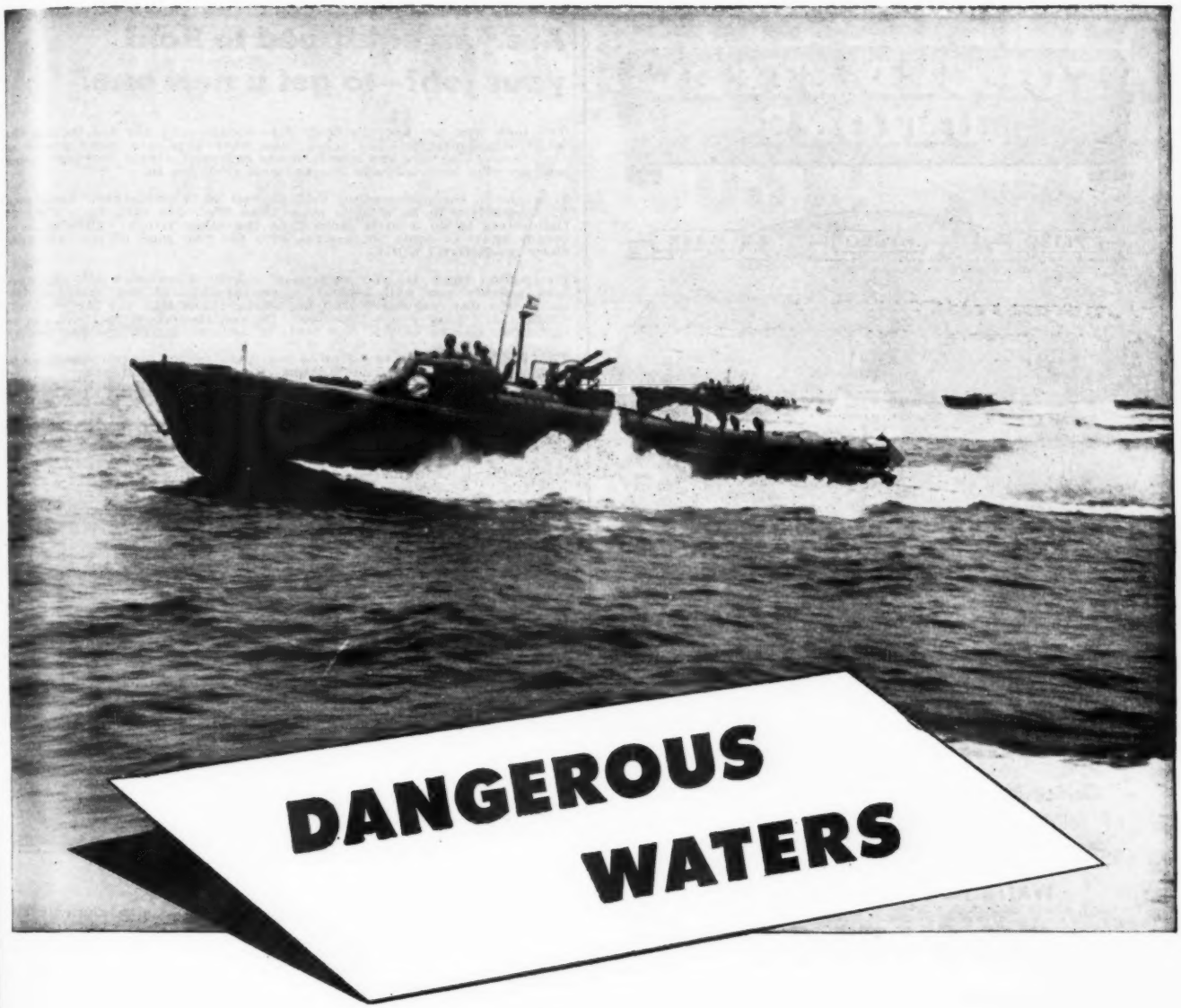

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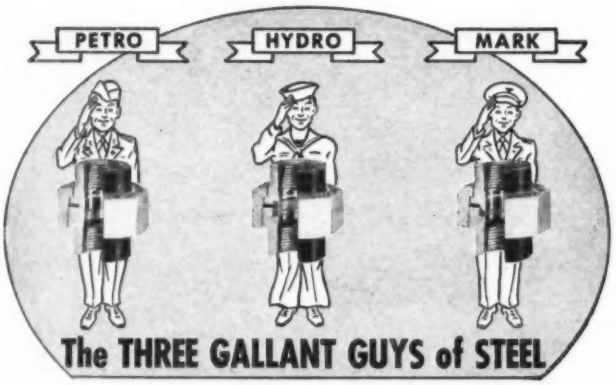

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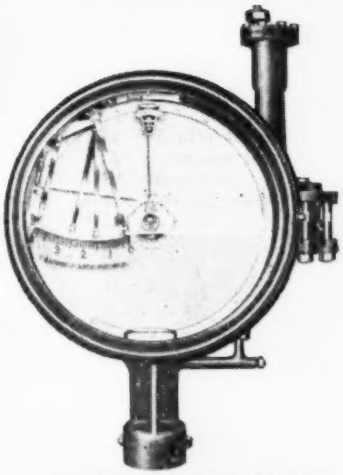

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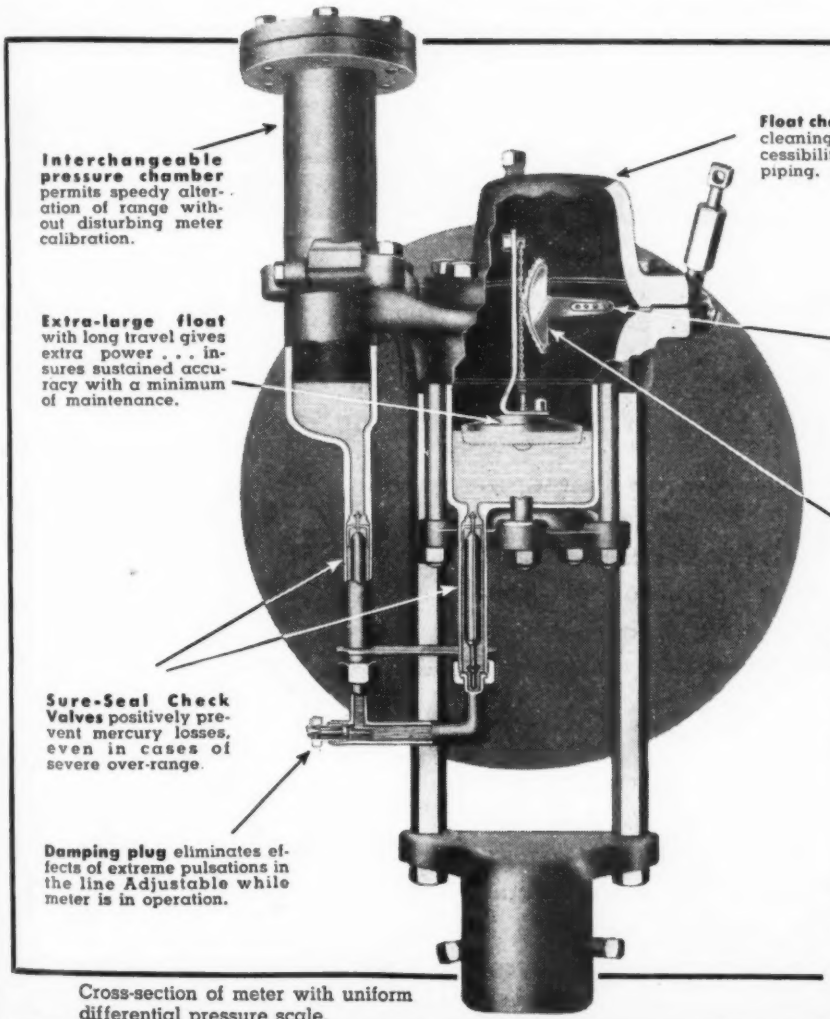
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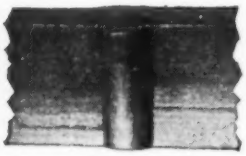

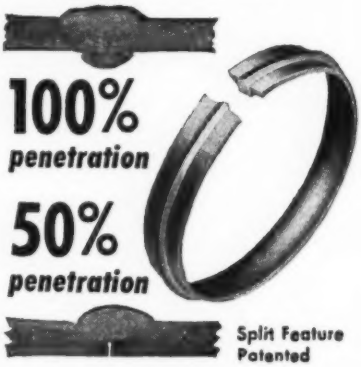

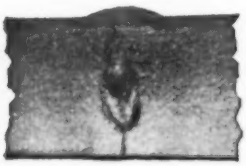

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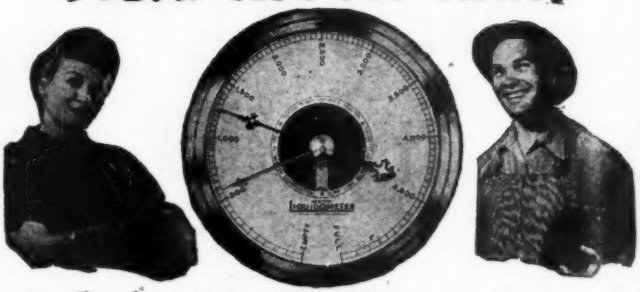

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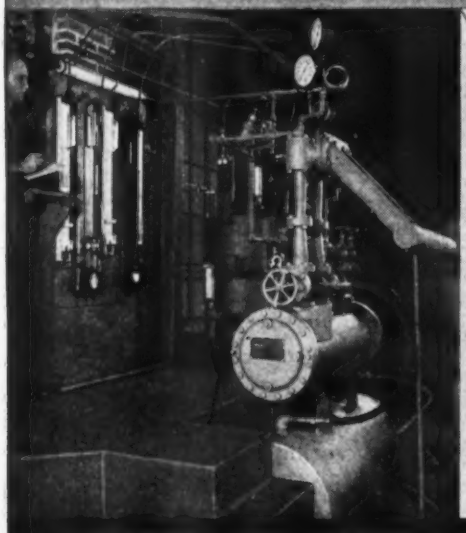

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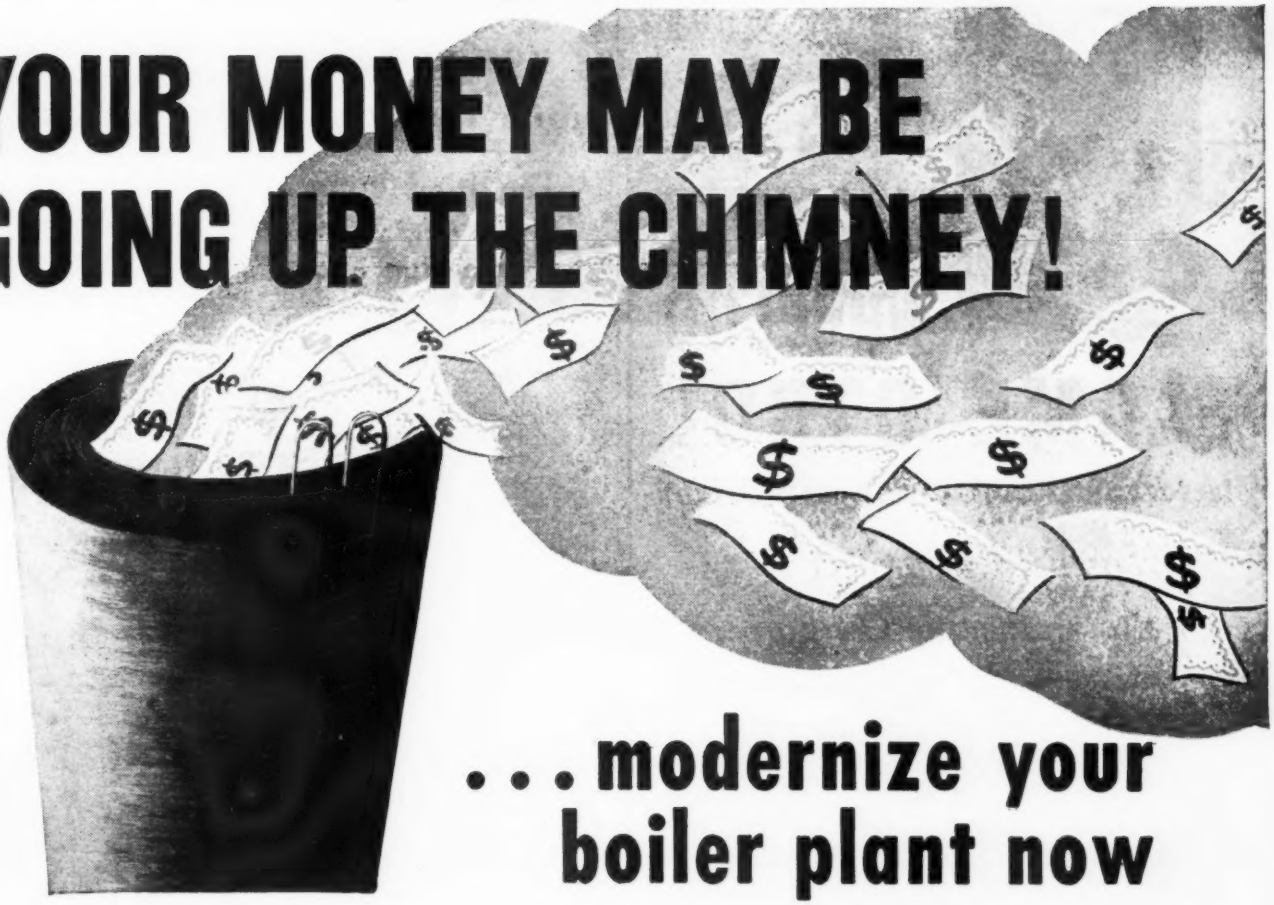

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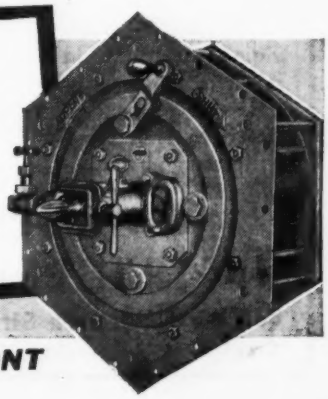

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as used to protect a
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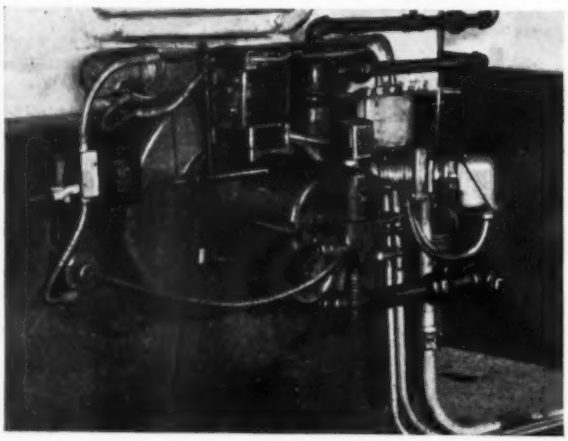

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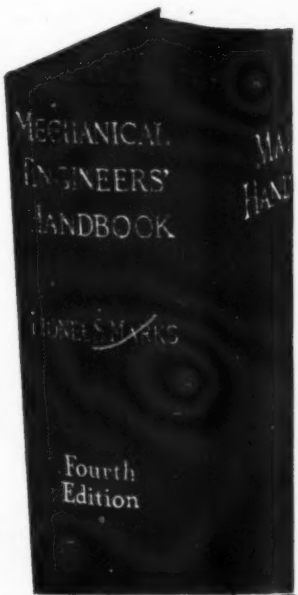

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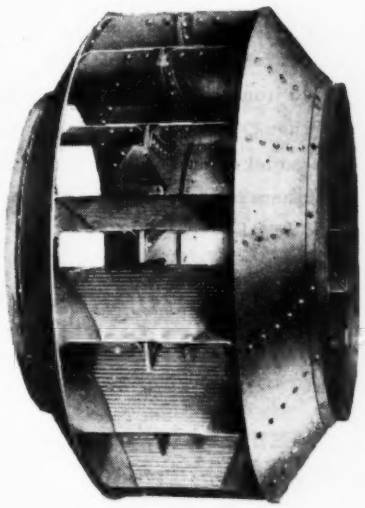

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AMERICAN-MADE RUBBER IS RESPONSIBLE FOR THE PRESERVATION OF INDUSTRIAL AMERICA!

• Industry had a faint heart the morning after Pearl Harbor was attacked. The question on all sides was: "What will America do for Rubber?"

The plan of what to do was quickly answered. The United States must have a stock pile of rubber independent of any other country. The plan started immediately . . . the execution required a little longer . . . the realization is just about here.

Industry is getting the rubber it needs, due entirely to that ingenuity, the like of which is known and practiced only by Americans. The United States is now definitely "over the hill" as far as the supply of rubber is concerned.

Quaker, with its progressive program has made quite an achievement in turning out Industrial Rubber Products. For years we have been experimenting with, and using, American-made (synthetic) rubber.

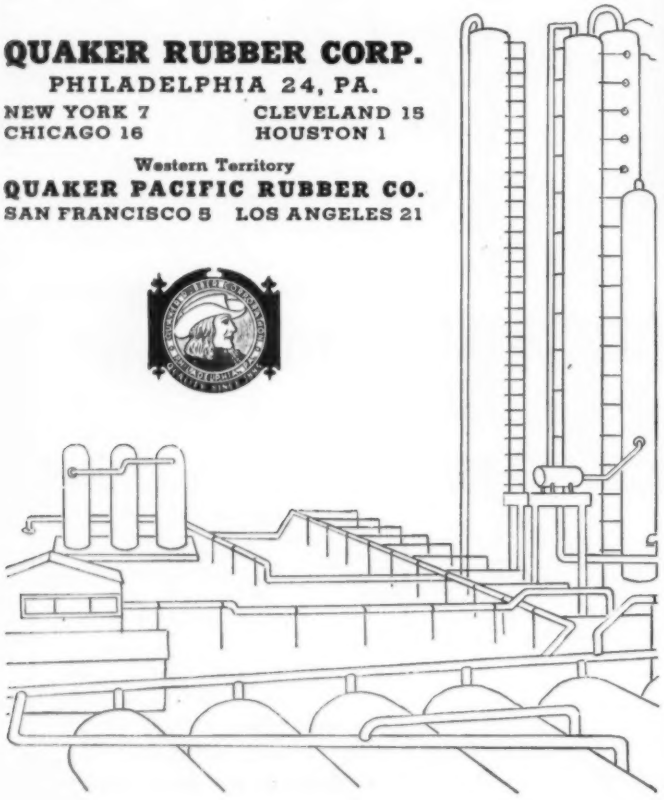
Our Laboratory technicians have developed so many applications where American-made rubber is definitely turning out products better suited for their particular task than when made from Crude.

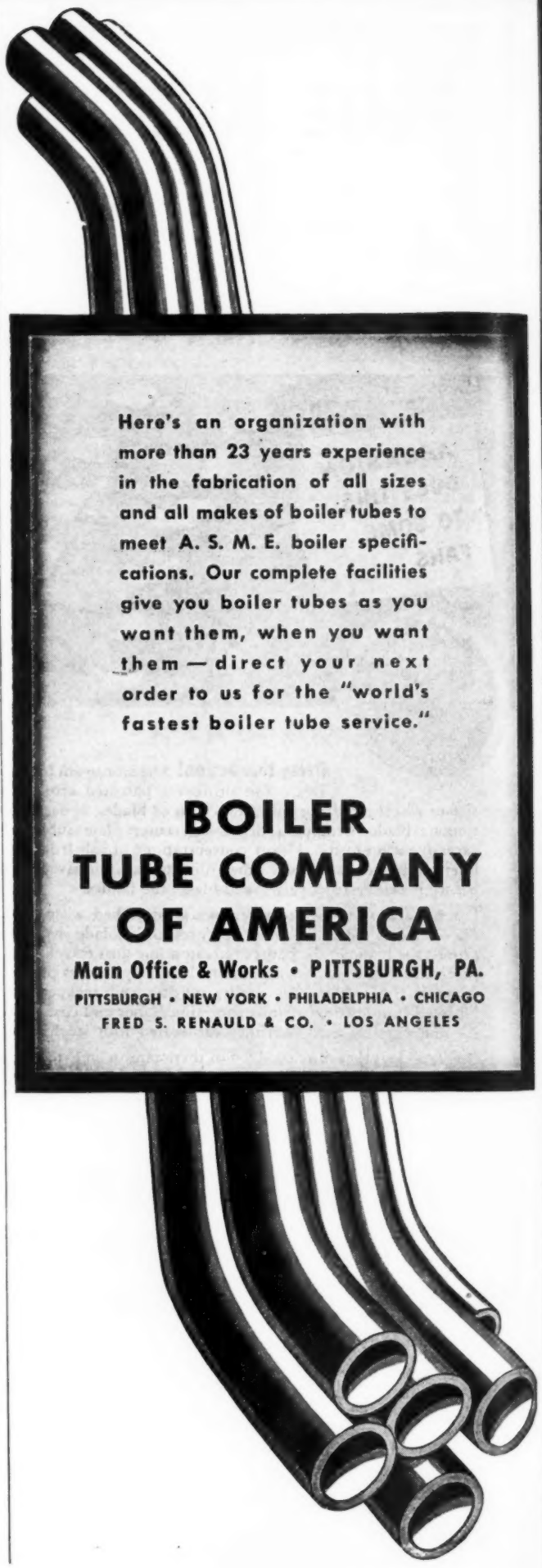
When Quality Belting, Hose or Packings are under consideration, think of Quaker.

If there is a way to get it done—Quaker will do it!

QUAKER RUBBER CORP.
PHILADELPHIA 24, PA.
NEW YORK 7 CLEVELAND 15
CHICAGO 16 HOUSTON 1

Western Territory
QUAKER PACIFIC RUBBER CO.
SAN FRANCISCO 5 LOS ANGELES 21





Here's an organization with more than 23 years experience in the fabrication of all sizes and all makes of boiler tubes to meet A. S. M. E. boiler specifications. Our complete facilities give you boiler tubes as you want them, when you want them — direct your next order to us for the "world's fastest boiler tube service."

BOILER TUBE COMPANY OF AMERICA
Main Office & Works • PITTSBURGH, PA.
PITTSBURGH • NEW YORK • PHILADELPHIA • CHICAGO
FRED S. RENAULD & CO. • LOS ANGELES

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

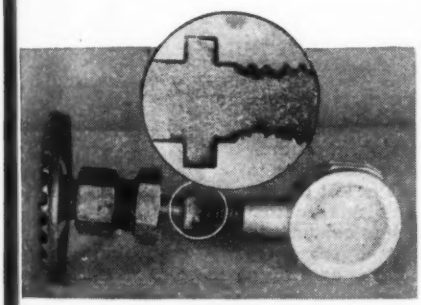
REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company — "Bridgeport" BRASS CO. — *Headquarters for BRASS, BRONZE, and COPPER*

Strengthen Vulnerable Parts and Improve Your Product

The stem was the vulnerable part of this excellent and well designed valve. After two years service in an artesian well system, the stem was the only part of the valve which showed appreciable service deterioration. Dezincification caused threads to break off in many places. Analysis revealed the brass to be unsuitable to this type of use.

There are many good products which may be made better by making all parts from materials engineered to meet necessary service requirements. For example, valve stems, nuts, bolts and similar items made from Bridgeport's DURONZE III, a silicon aluminum bronze, combine high strength with exceptional resistance to severe corrosion. DURONZE III has the tensile strength of many carbon steels. It machines freely, hot forges readily and has a surprisingly low coefficient of



Enlarged cross-sectional view shows the dezincification of the metal with resulting failure of the threads on the screw. This deterioration would be avoided through the use of DURONZE III, thereby increasing the serviceability of the entire valve assembly.

(continued from column 1)

friction when in contact with casting alloys commonly used in valve bodies and gates. DURONZE III resists season cracking, does not stretch or torque appreciably and may be generally depended upon to provide longer life and increased service.

Careful study of parts which fail in service often reveal improvement possibilities without necessitating design changes, by substituting modern alloys especially designed to combat excessive corrosion, fatigue, wear or deterioration. Bridgeport's 80-page DURONZE MANUAL, covering the technical details of DURONZE III and other Bridgeport silicon bronze alloys, is free for the asking. Every design engineer and plant superintendent should have a copy.

For Severe Corrosion Conditions —Cuzinal Condenser Tubing

Cuzinal (Aluminum Brass) Condenser Tubes were developed because of the steam turbine which depends upon a high vacuum for its maximum efficiency. To maintain a high vacuum it is necessary first to have a much greater flow of circulating water than required for reciprocating engines, and secondly the tubes must be kept as clean as possible.

The increase in water velocities through the tubes, which in the early days were either Admiralty or 70-30 Brass, led to a new type of corrosion, namely air impingement or erosion-corrosion. However, this high water velocity also has its advantages inasmuch as the rush of water expels sand, cinders, and other debris in addition to retarding the formation of slime. Under such conditions an alloy which is more resistant to air impingement than Admiralty is needed.

Bridgeport's Cuzinal which contains 76% copper, 2% aluminum and 22% zinc is far superior for handling high velocity sea water. To make it still better with respect to resisting deposits attack which may occur when silt and debris settle or attach themselves through the tube wall, Cuzinal contains a dezincification inhibitor in the form of arsenic. In addition, this alloy also is less scale forming, i.e., a thinner heat transfer retarding film will form on its surface than on some of the other alloys.

Bridgeport's staff of Metallurgists, Designers and Engineers will be glad to counsel with you upon your condenser tubing problems. If you have not already received it, why not send for your (free) copy of the Bridgeport Condenser Tube Manual, a comprehensive reference on all types of tubing used for condensers, heat exchangers, evaporators and general piping found in power plants, ships, oil refineries and process industries. Send for it . . . TODAY!

Note: Bridgeport products are supplied in accordance with existing priority regulations.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN.

ARMY E NAVY

BRASS

ESTABLISHED 1865

Do YOU need More Steam?

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Investigate the PERNET system of modern high pressure over-fire air equipment.

★

A recognized method of increasing boiler ratings with its incidental benefits of reduced fly ash, less tube slagging, and longer refractory life.

★

Applicable to any type of stoker or pulverized coal-fired boiler.

★

Electronically operated blowers are available for separate smoke elimination requirements, or the PERNET system as applied to the boiler can be utilized.

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25 years of engineering development, backed by operating experiences from hundreds of boiler applications, make the PERNET system of over-fired air one of major steps towards ultimate perfect combustion.

Your Inquiries Invited

POWER ENGINEERING CO.

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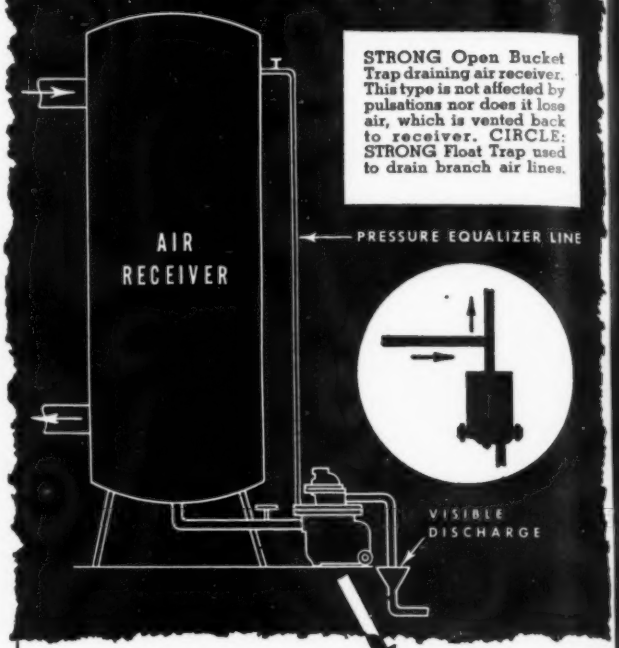
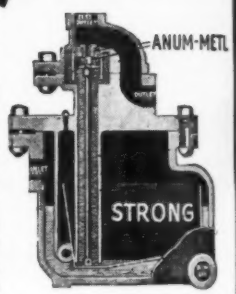
CHICAGO 11, ILLINOIS

DRAIN RECEIVERS WITH NO AIR LOSS



STRONG Open Bucket Trap draining air receiver. This type is not affected by pulsations nor does it lose air, which is vented back to receiver. CIRCLE: STRONG Float Trap used to drain branch air lines.

Reciprocating compressors cause pressure surges in air receivers. These pulsations tend to "bounce" buckets of inverted bucket traps, resulting in excessive wear of parts, continual discharge and loss of air.



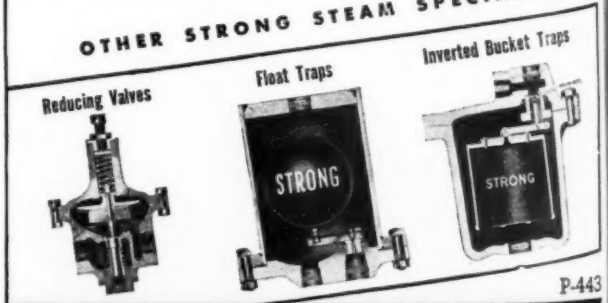
STRONG Open Bucket Traps are not affected by such pulsations. Only the weight of condensate in the bucket causes them to discharge. No air is lost during discharge, and air displaced from the trap by incoming condensate is vented back to the receiver.

This hook-up also is used for draining gas receivers and accumulators. Where liquids other than water are handled, special traps are furnished.

• • •

Completeness of the STRONG lines enable us to recommend exactly the type and size you need—open or inverted bucket, closed float, float-and-thermostatic (blast), etc.—forged, fabricated (welded), cast and semi-steel construction. Send your problems to Strong, Carlisle & Hammond Company, Cleveland, Ohio.

OTHER STRONG STEAM SPECIALTIES



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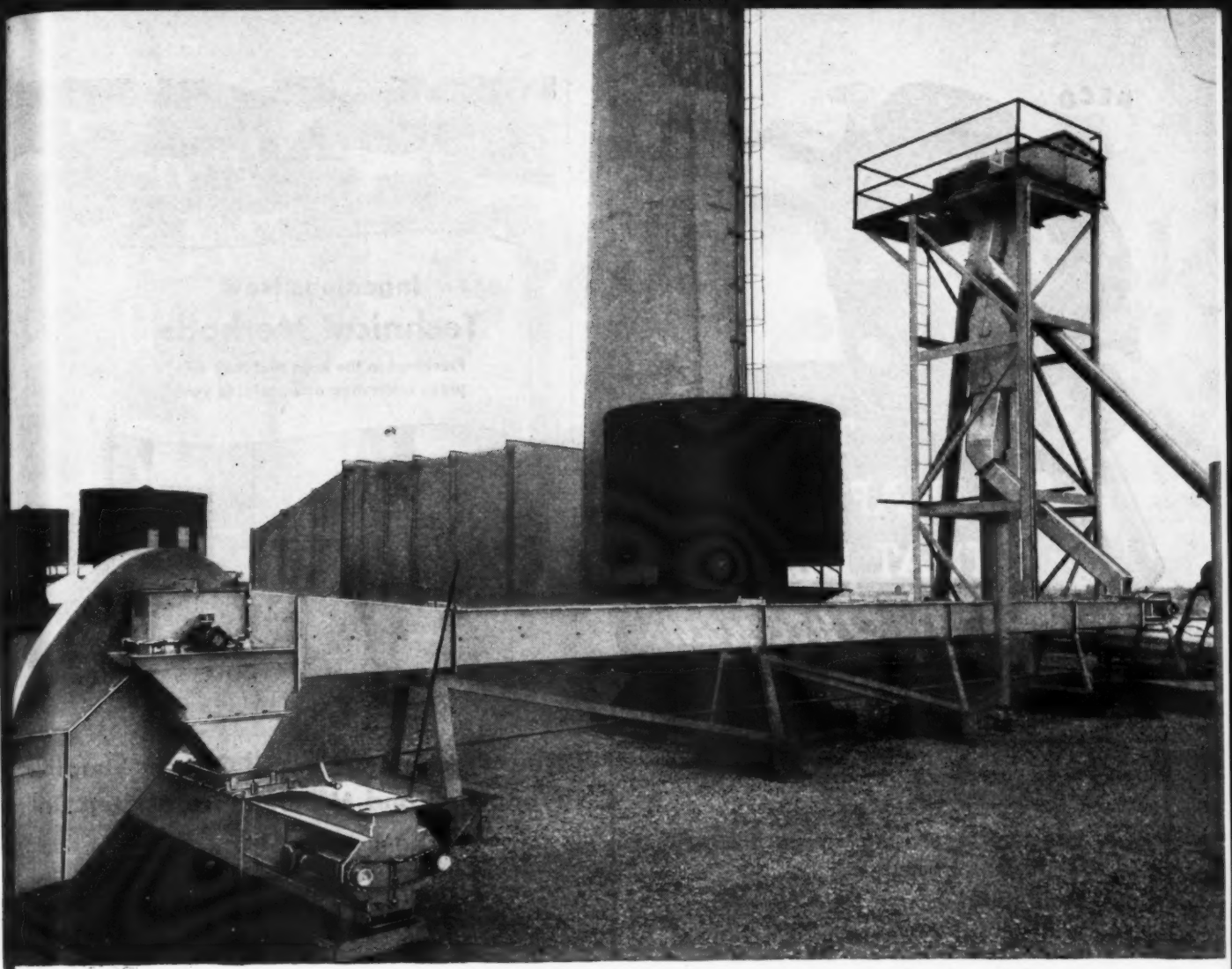
STRONG

STEAM SPECIALTIES



The unique coal handling system pictured above is located on the roof of a municipal power plant. Three compact Redlers, an elevator and two conveyors, store coal in silos, reclaim and distribute it to bunkers located beneath the roof. ALL REDLERS are completely weather-proof.

Unusual — BUT SOUND

S-A Equipment Plus S-A "Know-How" Are Equal to Any Handling Problem

● Each coal and ash handling installation presents its own problems. The very fact that the problems—and therefore the solutions—are different, explains why a great number of power plants depend on Stephens-Adamson for coal and ash handling equipment.

Stephens-Adamson manufactures a *complete* line of handling machinery, including conveyors, elevators, feeders, crushers and related accessories. In addition, S-A engineers are long experienced in assembling machinery units into speedy, efficient, low cost handling systems.

Take advantage of S-A's two-way service—engineering ability plus manufacturing facilities—when planning new or modernized coal and ash handling systems.

Write us for further information.

STEPHEN S-A ADAMSON MFG. CO.

RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of

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Model CHJ-A
Sizes: ½" to 2

THE SHAFT JOINT THAT DELIVERS THE *Optimum* TORQUE LOAD

- Effective operating range from 0 to 92° (manual)
- Graduated torque load capacity up to 20,000 inch-lbs. at 50 R.P.M.
- Complete direct lubrication to all contact surfaces.
- Complete size range in quality-tested materials.

Consult Brooks for:

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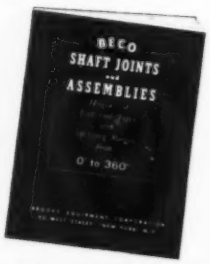
- Shaft Couplings
- Valve Controls
- Shaft Hangers
- Shaft Joints

Send today

for a registered copy of the new 48-page handbook showing blueprints and photographs of the complete BROOKS line of shaft joints and assemblies.

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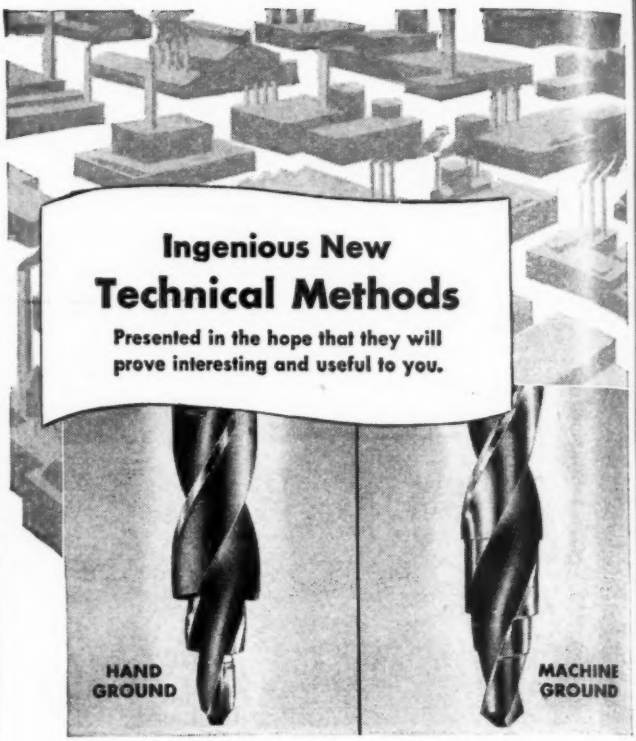

Ingenious New
Technical Methods
Presented in the hope that they will prove interesting and useful to you.
HAND GROUND
MACHINE GROUND

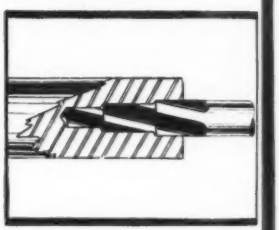
New Precision Step Drill Grinder Simplifies Production and Maintenance of Step Drills

The quality of a step drill produced by common methods depends almost entirely on the skill and attention of the individual tool maker. However, with the development of the precision step drill grinder, the human element has been entirely eliminated, the characteristics of the step being completely controlled by the grinding machine without adjustments during the course of grinding. This automatic feature insures absolute uniformity, regardless of quantity, and permits large-volume production of step drills.

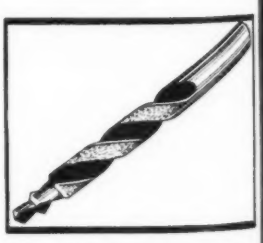
The apparent advantages gained through the use of the step drill grinder are: Permits mass production of drills ground to exact specifications, entirely independent of the human element. Maintenance, too, is no longer an obstacle as step drills produced by this method are quickly sharpened by the same uniform machine-controlled operation. With the step drill grinder step drills can now be made from standard drills. These advantages result in a wider application of step drills which provide a definite saving of machine tools, man-hours and cost; this in turn results in greater production.

You know there are plenty of benefits in chewing gum, too. That's why all of the Wrigley's Spearmint we're able to make from our available stocks is going overseas to our fighting men and women. You know what a lift it's been on the job and we wish we could supply everybody, because we have pride, too, in our workmanship and productivity. But there just aren't enough available top quality raw materials right now to do it. When we can produce it in sufficient quantity, it will be back to you with the same fine flavor and chewing satisfaction . . . Wrigley's Spearmint has never been changed!

You can get complete information from Spiral Mfg. Corp., 5022 North Kedzie Avenue, Chicago 25, Illinois.

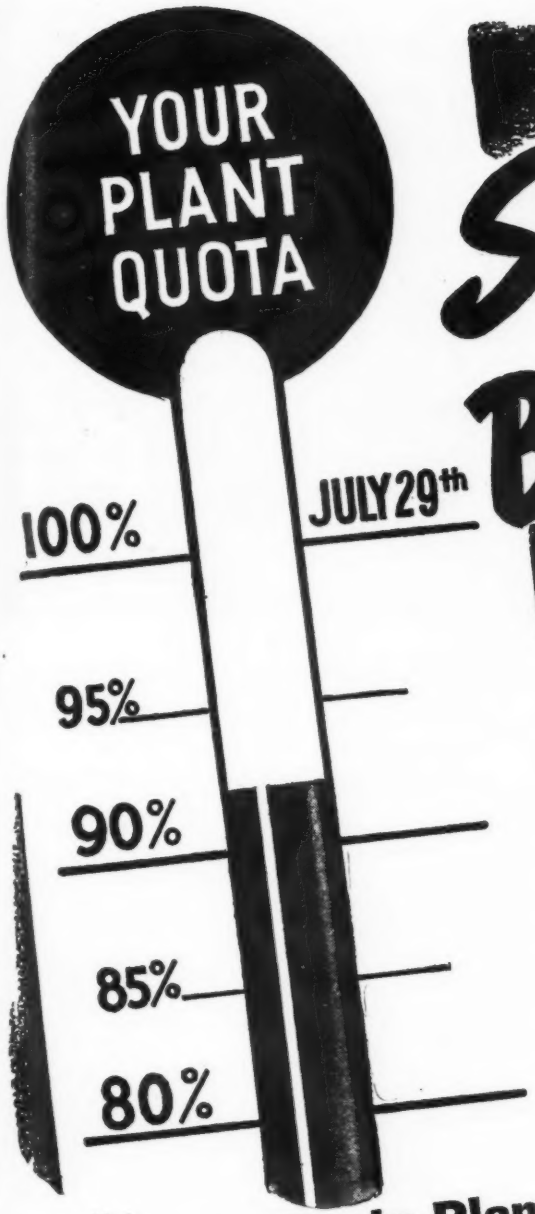


The above illustration shows mechanical design which requires a hole having diameters diminishing in steps. This is an operation for step drills which has often been neglected due to difficulty in obtaining and maintaining step drills.



Step drills produced by our method are quickly sharpened by the same uniform, machine-controlled method.

Y-126



Stay at Your Battle Stations!

MANAGEMENT • LABOR

—the 5th War Loan Drive is still on.

July 29th is the last pay day in the Drive.

The U. S. Treasury has set the overall goal at $16,000,000,000 —$6,000,000,000 from individuals alone. This is the biggest sum ever asked of the American people—*and it must be raised!*

Keep fighting. The 5th War Loan is a crucial home front battle of tremendous importance to the total war effort.

Tighten up your 5th War Loan Drive organization. Step up your solicitation tempo. Drive! Drive!! Drive!!! Hit your Plant Quota's 100% mark with a bang that'll proclaim to all the world that the U. S. Home Front is solidly in back of the Fighting Front.

Need help? Need ideas? Call on the Chairman of your War Finance Committee. He's standing by.

Here's the Quota Plan:

1. Plant quotas are to be established on the basis of an *average* $100 *cash* (not maturity value) purchase per employee.
2. Regular Payroll Savings deductions made during the drive accounting period will be credited toward the plant quota.
3. Employees are expected to contribute toward raising the cash quota by buying extra 5th War Loan Bonds: 1—Outright by cash. 2—By extra installment deductions. 3—By extra installment deductions plus cash.

Example: **JOHN DOE MFG. CO.**—1,000 Employees

1,000 Employees x $100 . . . $100,000 Cash Quota

Regular payroll deductions during the eight weekly payroll accounting periods of June and July. 30,000

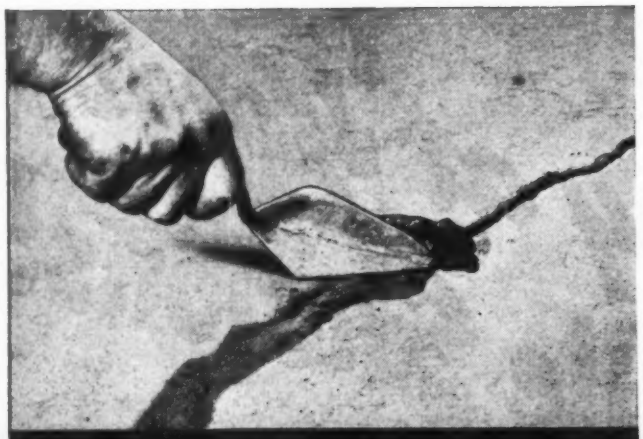
$70,000 (to be raised by sales of extra Bonds).

BACK THE ATTACK—SELL MORE THAN BEFORE

The Treasury Department acknowledges with appreciation the publication of this message by

POWER

★ ★ *This is an official U. S. Treasury advertisement—prepared under the auspices of Treasury Department and War Advertising Council.* ★ ★



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Don't let those ruts, cracks and crevices go too long — they can give you plenty of trouble. Repair them with Smooth-On No. 7B Quick Patch Cement — easy to use, quick to harden, lasting in results. Applied at evening, the patch is completely set by morning, without hampering plant operations.

Furthermore, because Smooth-On expands slightly as it hardens, Smooth-On patches *stay put*.

FREE 40-PAGE SMOOTH-ON REPAIR HANDBOOK

Describes hundreds of repairs to plant and home equipment. 170 diagrams. Send coupon for your copy, also Quick Patch folder.

Get Smooth-On No. 7B in 5-lb., 25-lb. or 100-lb. kegs from your dealer, or if necessary, from us. For your protection, insist on SMOOTH-ON, used by engineers and repair men since 1895.

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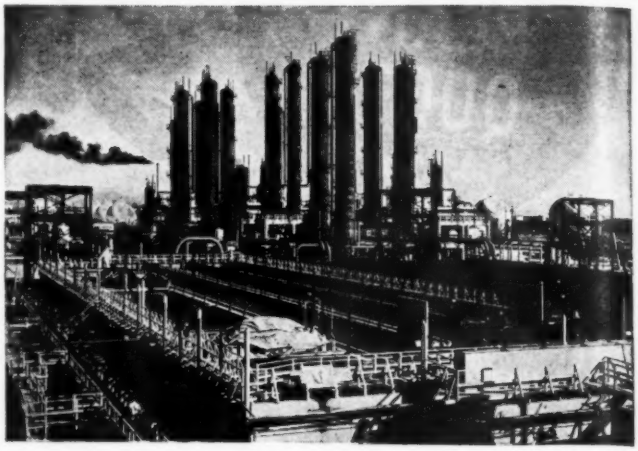
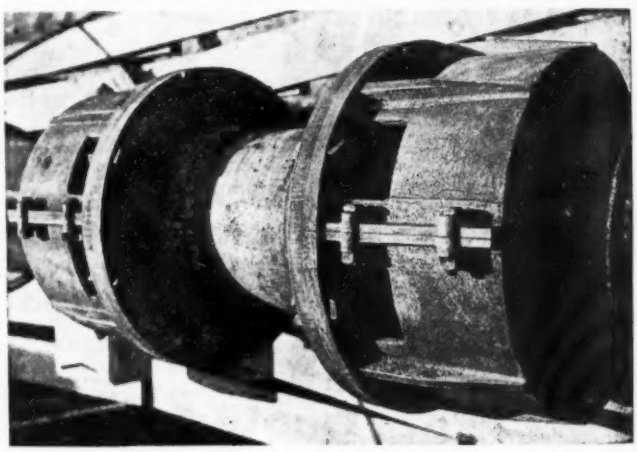
Do it with SMOOTH-ON
The Iron Repair Cement of 1000 Uses

Chalk up another BIG one for...



..ADSCO

Piston-Ring EXPANSION JOINTS



When the Lummus Company designed the Port Neches, Texas plant of the Neches Butane Products Company, they needed expansion joints that would permit of twenty-four hour operation, without necessity for shutting down any line at any time for repacking the joints.

The several hundred ADSCO Expansion Joints in sizes up to 20" installed on this project include the ADSCO Piston-Ring Expansion Joint which is the only slip type joint that can be unpacked and repacked under full operating pressure and is the choice of Engineers for every job where interruption to service must be eliminated. Also installed on this job are ADSCO Pipe Alignment Guides, Pipe Supports and Saddle Plates. Write for Bulletin No. 35-15E.

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Removal of two bolts frees the top cap—and the valve and seat are completely exposed to view.

Squires

The accessible Squires has become a byword among power plant operators.

Reliability and economy are among its popular points and besides Squires Traps positively will not wire draw.

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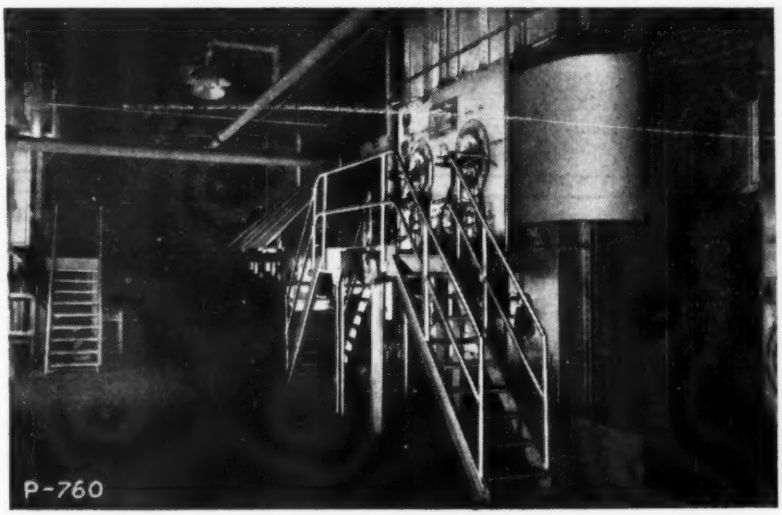
FOR FIRING LARGE CAPACITY STEAM GENERATORS

With Mechanical Atomizing Oil Burners. The type M A Oil Burners mounted in model F Universal Registers are available for capacities up to 500 gals. per hr. Air vanes are variable independently of each other and adjustable or instantly reversible for left or right hand turbulence. Air volume controlled independently of turbulence.



Two National Airoil Type M A Mechanical-Pressure Atomizing Fuel Oil Burners and Universal Registers are shown here firing a 70,000 pound steam generator. This is the third identical order we received from this company, a definite proof of satisfaction. The equipment permits full capacity operation on forced draft and partial capacity on natural draft. Our experience with this and numerous similar installations shows this arrangement of National Airoil Burner Equipment provides an *efficient economical* and *trouble-free* means of firing with fuel oil, high capacity steam generators in refineries. For help on meeting *any* refinery combustion problem, call on us. Our 32 years' experience is at your service.

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supplements other advertising in this issue with these additional announcements of products and services essential to efficient and economical power operation and maintenance. Make a habit of checking this page, each issue.

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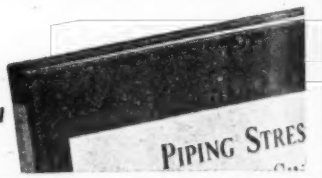

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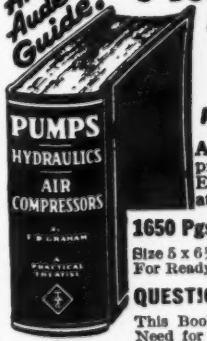

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75 H.P.—G. E. S1—230 Volts—550 RPM
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2-Ton Shepherd Hoist With 3-H.P. Hoist Motor and 2-H.P. Trolley Motor 3 Phase. Can Be Used Remote Control.

@300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle 750 speed with transformers for 2300 volts to 230 volts D.C.

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40 KW GE type I.T.T. frame 553 3 ph. 25/62, ½ cy. 220 volts primary 440 volts secondary, 750 R.P.M. direct con. to 40 H.P. GE type KT543—3 ph. 25 cy. 220 volt, 750 R.P.M.

OTHERS IN ALL SIZES VOLTAGES AND CYCLES

3 ph. 60 cy. A. C. MOTORS

H.P.	Make		Type	Speed	Volts
250	West	S.C.	C. S.	900	440
200	West	Syn.	.08 P. P.	900	220/440
		WITH DIRECT CON. EXCITER			
200	Wsghse.	Sl.Rg.	CW	600	220/440
200	Wsghse.	Syn.	Dir. Con. Exc.	600	2300
200	Gen. Elec.	Syn.	ATi	514	400/2300
150	Gen. Elec	Sq. Cg.	I	600	2300
150	Al Ch	Sq. Cg.		600	440
150	Burke	Sq. Cg.	3 BRG. 2 ph.	900	220/440
125	Gen. Elec.	Sl. Rg.	NT. 553	1200	220
125	Gen. Elec.	Sq. Cg.	I K	720	220/440
25	Gen. Elec	Sq. Cg.	I. K. Vert.	720	220

3 ph. 25 cy. MOTORS

H.P.	Make		Type	Speed	Volts
830	Elec. Mach.	Syn.	Dir. Con. Exc.	500	2300
350	Gen. Elec.	Sl. Rg. 3 Brg.	I	375	440
200	Lincoln	S. R.	I. X. W.	500	440
150	Gen. Elec.	Sl. Rg.	I Form M	500	2200
100	Wagner	Sl. Rg.	BR	750	220/440
100	Gen. Elec.	Sl. Rg.	I Form M	750	220/400
100	Gen. Elec.	Sq. C.	I K	750	220/440
100	Wsghse.	Sq. C.	CS	500	220/440
75	Wsghse.	Sq. C.	CCI.	500	220/440
75	Gen. Elec.	Sl. Rg.	I M	750	220/440
75	Wagner	Sq. C.	BM	750	2200
75	Gen. Elec.	Var.	BTA	375/750	440

230 D. C. MOTORS

H.P.	Make	Type	Speed
150	West	SK 180L Comp. Wd. Int.	1150
100	Northwestern	K30 Comp. Inter.	1750
85	Gen. Elec.	Vert. Comp. Wound	700
75	Crocker Wh.	CCM25JA	1700
67	Otis	Elevator Motor Comp. wd.	1200
60	Sprague	D—Comp. Wound	625
50	Gen. Elec.	C. L. 6 Shunt Wound	560
40	Fair. Morse	Ball BRG. Vert. Comp.	1740
35	West	SK 150—Shunt in 550 volts	850

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3 Phase, 60 Cycle

1500 KW WESTINGHOUSE synchronous, 250 volts D.C., 2300 volts A.C., 514 RPM.

1000 KW GENERAL ELECTRIC 3-UNIT synchronous 125/250 volts D.C., 4000/2300 volts A.C., 720 RPM.

500 KW GENERAL ELECTRIC synchronous, 250 volts D.C.; 4000 volts A.C., 900 RPM.

300 KW WESTINGHOUSE synchronous, 250 volts D.C., 2300 volts A.C., 1200 RPM.

TURBO GENERATORS

3 phase 60 cycle

15,630 KVA GENERAL ELECTRIC condensing, 200 lbs., 6600 volts with surface condenser

4000 KVA ALLIS CHALMERS condensing, 175 lbs., 2300 volts with jet condenser

3750 KVA GENERAL ELECTRIC condensing, 200 lbs., 2300 volts with surface condenser

1875 KVA GENERAL ELECTRIC condensing, 160 lbs., 2300 volts with surface condenser

1250 KVA ALLIS CHALMERS condensing, 150 lbs., 2300 volts with jet condenser

TURBO GENERATOR

250 volts D.C.

500 KW GENERAL ELECTRIC automatic extraction, 150 lbs. 0-28 lbs. extraction, with surface condenser

SURFACE CONDENSER

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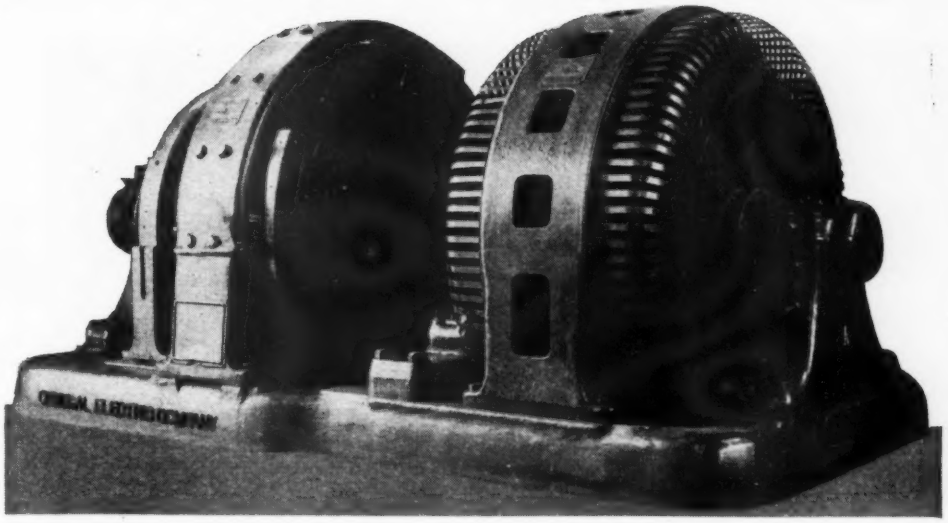
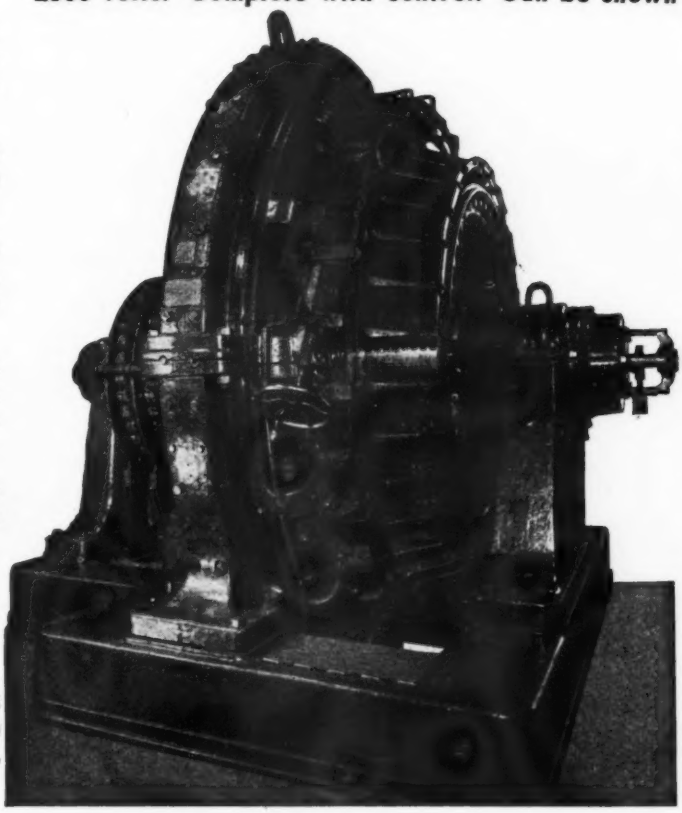


Actual Photograph

1000 KW Motor Generator Set

1000 KW General Electric generator 250 volts, 720 RPM direct connected to 1400 HP General Electric synchronous motor, 3 phase 60 cycle 4150/2300 volts. *Complete with control. Can be shown in operation.*



Actual Photograph

3500 KW Rotary Converter

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ROTARY CONVERTER

3 Phase, 60 cycle

750 KW GENERAL ELECTRIC 600 volts D.C., 1200 RPM with 2300/4000 volt transformers

ENGINE GENERATORS

3 Phase, 60 Cycle

260 KVA GENERAL ELECTRIC SKINNER uniflow, 115 lbs., 10 lbs. back pressure, 440 volts

210 KVA GENERAL ELECTRIC engine type generator, 2300 volts, 225 RPM

188 KVA CROCKER WHEELER SKINNER counterflow, 125 lbs., 5 lbs. back pressure, 208/120 volts, 4-wire.

150 KVA GENERAL ELECTRIC AMES counterflow, 125 lbs. 5 lbs. back pressure, 240 volts

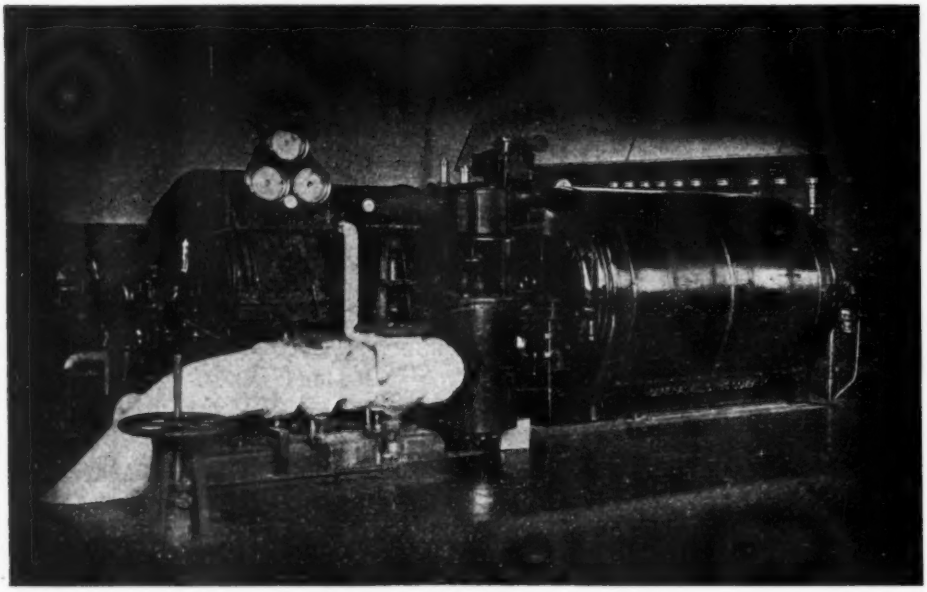
ENGINE GENERATOR

250 volts D.C.

500 KW CROCKER WHEELER-AMES, 4 cylinder vertical uniflow, 150 lbs., 4 lbs. back pressure

THE NATIONAL POWER MACHINERY CO.
1921 SCRANTON ROAD CLEVELAND, OHIO

3125 KVA CONDENSING TURBINE-GENERATOR UNIT



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Excellent condition—a complete installation.

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1875 KVA G.E. condensing 175-200 lb. pressure, 500° T.T. 6600 volts, 3600 RPM complete with condenser.

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625 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM complete with condenser and auxiliaries.

375 KVA G.E. condensing 150-200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser and auxiliaries.

375 KVA (2) G.E. non-condensing, 150-175 lb. pressure, 5 lb. back pressure, 2300 volts, 3600 RPM each complete with direct connected exciter.

125 KVA G.E. non-condensing, 110-125 lb. pressure, 0-10 lb. back pressure, 240 volts, 3600 RPM complete with switchboard.

ROTARY CONVERTERS

1500 KW Westinghouse synchronous 250 volts, direct current—6 phase, 60 cycle alternating current, 514 RPM.

ENGINE-GENERATOR UNITS

Direct Current

1000 KW Westinghouse, 250 volts, 514 RPM generator direct connected through reduction gear to Westinghouse condensing turbine, 150-200 lb. pressure, equipped surface condenser.

600 KW Crocker-Wheeler, 250 volts, 300 RPM generator direct connected to a 14" x 18" 4 cylinder Ames vertical Unaflow non-condensing engine, 150-175 lb. pressure, 5 lb. back pressure, complete with switchboard.

400 KW Crocker-Wheeler, 250 volts, 150 RPM generator direct connected to a 26" x 32" Skinner Unaflow non-condensing engine.

400 KW (2) General Electric, 250 volts, 150 RPM generators each direct connected to Elliott Ridgway 4-valve engine.

250 KW G.E., 250 volts, 150 RPM generator direct connected to a 20" x 28" Chuse non-releasing Corliss engine complete with switchboard.

75 KW 125 volt, 1800 RPM Westinghouse direct current non-condensing turbine-generator unit.

75 KW, 125 volt, 2400 RPM Allis Chalmers-Terry non-condensing turbine-generator unit.

15 KW (3) Crocker-Wheeler, 125 volt, 410 RPM generators each direct connected to an American Blower vertical engine.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle

Alternating Current

625 KVA Allis (2), 440 volts, 150 RPM generator direct connected each to a 26" x 30" Hamilton Corliss engine, 125-150 lb. pressure.

375 KVA G.E. 2300 volts, 200 RPM generator direct connected to a Chuse cross compound 4-valve non-releasing Corliss engine.

312 KVA G.E. 2300/480 or 240 volt, 200 RPM generator direct connected to a Chuse 4-valve non-releasing Corliss engine.

312 KVA Elliot 4000/2300/550 or 240 volts, 180 RPM generator direct connected to a 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. back pressure.

250 KVA Westinghouse, 2300 or 480 volts, 200 RPM generator direct connected Nordberg Unaflow engine.

MOTORS

—3 phase, 60 cycle

900 HP G.E. 240 volts, 900 RPM synchronous.

500 HP 80% P.F., G.E., 240 volts, 900 RPM synchronous motor with direct connected exciter.

125 HP 80% P.F. Elec. Mchy, 440 volts, 400 RPM synchronous.

60 HP G.E. 220 volts, 900 RPM squirrel cage induction complete with starting compensator.

50 HP G.E. type I, form M, 2200 volts, 1200 RPM slip ring.

50 HP Allis-Chalmers, 440 volts, 600 RPM squirrel cage.

SYN. MOTORS

3 phase, 25 cycle

1700 HP G.E. 2300 volts, 300 RPM.

910 HP Westgh. 2300 volts, 300 RPM.

MOTOR GENERATOR SET

1500 KW Allis-Chalmers, 600 or 275 volt direct current generator direct connected to 2190 HP, 3 phase, 60 cycle, 4000/6600 volt, 300 RPM synchronous motor.

FREQUENCY CHANGER SETS

750 KVA Westinghouse, 3 ph., 60 cy., 2300 v. alternating current generator dir. con. to 910 HP, 3 ph., 25 cy., 2300 v., 300 RPM syn. motor.

1200 KVA General Electric, 3 ph., 60 cy., 2400 v. alternating current generator dir. con. to 1700 HP, 3 ph., 25 cy., 2300 v., 300 RPM syn. motor.

SPECIALS

500 KVA G.E. 3 phase, 60 cycle, 2300 volt, 450 RPM belted generator.

165 KW Electric Machinery, 3 phase, 60 cycle, 2400 volt, 514 RPM belted generator.

22" x 48" Nordberg Corliss belted type engine, 150 to 175 lb. pressure, 100 RPM.

SYNCHRONOUS CONDENSERS

1350 KVA

Total Capacity

750 KVA and 600 KVA G.E. type ATI, 3 phase, 60 cycle, 240 volts, 900 RPM synchronous condensers each complete with direct connected exciter, switchboard panel with instruments. Are in A#1 operative condition — still on original foundation for operating test.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

MOTORS GENERATOR SETS

1—750 KW, 250 volt, Allis Chalmers, synchronous
2—150 KW, 125 volt Westinghouse, synchronous
1—75 KW, 125 volt, General Electric, squirrel cage.
1—20 KW, 600 volt, General Electric, squirrel cage induction motor.
2—15 KW, 250 volt, General Electric, squirrel cage
1—6¼ KW, 125 volt, General Electric, squirrel cage.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chal.

MOTORS—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, Lincoln, 440 volt, slip ring.
1—400 HP, 514 RPM, 440 volt, Westg., slip ring.
1—350 HP, 300 RPM, 440 volt General Electric slip ring.
1—335 HP, 600 RPM, 2300 volt, G.E., syn.
1—300 HP, 720 RPM, 2200 volt, G.E., slip ring.
1—250 HP, 514 RPM, 4000 volt, G.E., syn.
1—250 HP, 600 RPM, 4000 volt, G.E., syn.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, General Electric, squirrel cage.
1—150 HP, 1750 RPM, Westinghouse, sl.rg.
1—150 HP, 1200 RPM, General Electric, squirrel cage.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—100 HP, 900 RPM, 440 volt, G.E., sl. rg.
3—100 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—125 HP, 720 RPM, Allis Chalmers, sl. rg.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., sl. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.

INSTRUMENTS

25—Westinghouse type U Recording Ammeters with slit core, CT.

25—Westinghouse type U Recording Volt-meters.

MOTORS—3 PHASE 60 CYCLE (Con't)

2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, 400 RPM, 550 volt, Cr. Whlr., sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, G.E., sq. cg.
1—75 HP, 720 RPM, 440 Volt, Westghse., slip ring.
1—75 HP, 720 RPM, 440 volt, G.E., sq. cg.
2—75 HP, 1200 RPM, 2200 volt, G.E., Vertical.
1—50 HP, 900 RPM, 440 volt, G.E., sl. rg.
1—50 HP, 900 RPM, 440 volt, G.E., sq. cg.

MOTORS—D.C. 230 VOLTS

2—450 HP, G.E., 400 RPM, Type MPL Form 1-F.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, Westghse., 550 RPM, Type SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—80 HP, Crocker-Wheeler, 600 RPM, Type CMC.
1—75 HP, G.E., 675 RPM, Type C, Sprague; with spare armature.
1—65 HP, 1000 RPM, G.E., Type RC.
8—50 HP, Crocker-Wheeler, 700 RPM, Type CM.
1—65 HP, G.E. 625 RPM Type DLC—65, Form A.
1—50 HP, 750 RPM, Westghse., Type SK.
1—50 HP, 700 RPM, Crocker-Wheeler.
1—40 HP, G.E.-Sprague, 700 RPM, Type LC.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, G.E.
1—30 HP, 750 RPM, G.E., type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
130 HP, G.E., 1100 RPM, Type RC-31B, Form A-21.
1—35 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E., 625 RPM, Type C.
1—25 HP, Westghse., 600 RPM, Type SK.
2—25 HP, G.E., 775 RPM, Type RC-13.
1—20 HP, G.E., 800 RPM, Type RC-13, Form A.
1—15 HP, G.E., 800 RPM, Type RC-11.

TRANSFORMERS

2—400 KVA, G.E., 4156-250/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—150 KVA, G.E., 33,000/2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200-250 volts.
3—75 KVA, G.E., 13,500-750/440 volts.
3—75 KVA, General Electric, 2200/220/110.
1—75 KVA, G.E., 3 phase, 4156Y—120/208Y.
3—50 KVA, G.E., 2200/220/110
2—50 KVA, Pbgh. 7500/15000 volts-110/220 volts.
3—37½ KVA, G.E., 2200/220/440.
2—30 KVA, Allis Chalmers, 3 phase, 4156Y/120/208Y.
1—25 KVA, G.E., 220/110-220/110 volts
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—35 HP, 500/1500 RPM, Westinghouse.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
7—25 HP, Westinghouse, 650/2200 RPM. Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

TURBO-GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 430 volt, bleeder.
1—375 KVA, Westghse., non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v., con.
1—200 KW, G.E., 3 ph., 60 cy., 220 v., cond.

Hemphill FOR POWER

J. L. HEMPHILL & COMPANY

1602 53rd ST., NORTH BERGEN, N. J.

PHONE NEW YORK—LONGACRE 5-3227 NEW JERSEY—UNION 3-2600

L. J. LAND AND COMPANY

MOTORS & GENERATORS

SOLD WITH A ONE-YEAR GUARANTEE

DIRECT CURRENT

(Partial List Only)

230 VOLT DC MOTORS

H.P.	Make	Speed
60	El. Dynam.	900
60	Roth	600
60	G.E.	480/1100 (2)
50	West.	550/1100
50	Cr. Wh.	700 (2)
50	G.E.	850
45	Diehl	850/1020
40	El. Dy.	1200
40	Cr. Wh.	915
35	West.	1150
25	Diehl	850/1020
25	G.E.	1150
25	G.E.	575
20	Cr. Wh.	1750
20	R & M	1160
20	G.E.	1150 (4)
20	West.	1150
20	G.E.	800 (2)
15	West.	1250
15	G.E.	1150 (3)
15	Cr. Wh.	900/1800
15	West.	850
10	West.	850 (2)
10	G.E.	825 (3)
10	G.E.	700
10	Al. Ch.	600/1800
10	West.	600/1200
10	G.E.	400/1600
10	West.	400/1200 (2)
9	G.E.	450/1800
8½	Diehl	900
8½	West.	850
8½	West.	350/1400
7½	Sturt.	3600
7½	Peerl's	1700
7½	West.	1450
7½	West.	1150 (2)
7½	G.E.	1150
7½	West.	975
7½	Al. Ch.	850
7½	El. Dy.	550/1650
7½	Watson	525/1150
7½	G.E.	400/1600
7½	West.	400/1600
7½	Al. Ch.	350/1050
7½	G.E.	300/1200
6	G.E.	400/1200
6	G.E.	450/1800 (2)
5½	West.	500/1500 (2)
5	West.	850
5	G.E.	900 (2)
5½	G.E.	400/1600
5	West.	1800
5	G.E.	1700
5	G.E.	1150 (2)
5	West.	1100
5	Al. Ch.	1150
5	Cont.	600/1800
5	West.	850
5	G.E.	850
5	Star	600/1200
5	El. Dy.	550/1650
5	G.E.	450/800
5	G.E.	600
5	G.E.	450/1350
5	West.	400/1200
5	El. Dy.	275/1100
4	G.E.	850/1150
3½	West.	850/1600
3	West.	1700
3	West.	1150 (6)
3	Roth	500/2000
3	G.E.	500/1500
2½	West.	480/1800

236 additional 230 volt D. C. Motors in stock as small as 1/20 H.P.

115 VOLT DC MOTORS

H.P.	Make	Speed
90	G.E.	900
20	West.	200/900
15	West.	1100
15	Cr. Wh.	800
10	L. Allis	3500
10	West.	850
10	El. Dy.	425/1275
7½	G.E.	850 (2)
6	Burke	650
5	Cr. Wh.	1875
5	West.	1100 (2)
5	Cr. Wh.	960

75 additional 110 volt Motors down to 1/6 H.P.

BELTED AND MOTOR DRIVEN DC GENERATORS

100 KW West.	125 volts
100 KW West.	250 volts
96 KW G.E.	60 volts
75 KW West.	250 volts
60 KW G.E.	600 volts
60 KW G.E.	125 volts
50 KW West.	125 volts
48 K West.	30 and 60 volts
45 KW West.	250 volts
30 KW El. Dy.	600 volts
40 KW Cr. Wh.	125 volts
30 KW West.	125 volts
25 KW West.	125 volts
25 KW G.E.	250 volts
20 KW G.E.	125 volts
15 KW West.	125 volts

43 additional Motor Generator Sets, 30 volts, 60 volts, 125 volts, 250 volts, and 250 volts as small as ½ K.W.

ALTERNATING CURRENT

(Partial List Only)

2 & 3 PHASE SLIP RING

H.P.	Make	Speed
250	G.E.	600
200	West.	580
200	G.E.	495
125	West.	1175
125	Burke	580
112	G.E.	900
100	F. M.	690
75	West.	1170
75	Al. Ch.	575
64	G.E.	585
60	West.	1135
60	West.	290
50	Ideal Vert.	1740
50	G.E.	870 (2
50	West.	850
40	Wagner	1150
40	F. M.	870 (2)
40	West.	870
40	Linc.	690
30	G.E.	870
30	G.E.	690
15/35	West.	6/1200 (5)
25/55	G.E.	6/1200
20/50	West.	6/1200
25	Al. Ch.	870 (2)
25	West.	850
25	G.E.	870 (2)
25	G.E.	720
25	West.	575
20	G.E.	870
20	West.	575

116 additional Slip Ring Motors in stock down to ½ H.P.

3 PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
200	G.E.	600
150	G.E.	860
147	West.	715
100	G.E.	1200
100	West.	1750
100	West.	720
100	G.E.(BTA)	375/750
75	West.	870
50	West.	1200
50	G.E.	900
50	Al. Ch.	690
40	G.E.	900
35	Wagner	850
30	U. S.	3450 Vert.
30	West.	1750 Vert.
30	Al. Ch.	514
25	Wagner	1200
25	West.	1140
25	Diehl	865 (3)
25	G.E.	900
25	Wagner	720
20	G.E.	1750 (3)
20	G.E.	1200 (2)
20	Cr. Wh.	1200 (2)
20	Al. Ch.	900 (2)
20	Diehl	900 (3)
20	G.E.	720
20	West.	1720
15	Cr. Wh.	1700
15	G.E.	1200 (3)
15	Wagner	720
15	G.E.	600
10	G.E.	720 (5)
10	G.E.	3450
10	West.	1150

325 additional three phase Motors down to ¼ H.P.

TWO PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
75	Cr. Wh.	870
50	Linc.	900
50	G.E.	900
40	G.E.	900
40	Al. Ch.	900
35	Al. Ch.	900
30	West.	1200
25	G.E.	1200
20	West.	1150
15	G.E.	1200
15	F & M	900
10	G.E.	1200
10	G.E.	900
7½	G.E.	900
7½	G.E.(BQS)	600/1350
5	G.E.	900
5	Al. Ch.	1200

146 additional two phase Motors down to ¼ H.P.

SINGLE PHASE MOTORS

H.P.	Make	Speed
20	Wagner	1160
20	Cent.	1165
7½	Cent.	3500

38 additional single phase Motors.

AC GENERATORS

150 KW G.E.	720
100 KVA West.	600
75 KVA West.	900
25 KVA West.	1200

New York City's Largest Stock Electrical Machines

ESTABLISHED 1910

146 Grand St. • CAnal 6-6976 • New York 13, N. Y.

Office
Reading, Penna.
10th & Exeter Sts.

Office
York, Penna.
323 E. Market St.

SPECIAL

33—15 H.P. 4-speed constant horsepower 600/900/1200/1800 RPM Ball Bearing Motors, 3/60/440 v.

10—4 speed Allen-Bradley Magnetic Starters

General Electric
Westinghouse
Louis Allis.

How the Policy of BELYEA Protects You—*the buyer*

Before you buy any piece of used or rebuilt electrical equipment — consider carefully this simple 5-point Belyea policy.

It's the reason why experienced plant engineers depend on Belyea for square dealing and satisfaction. It's the explanation of the 38-year growth of this Company from a small plant to its present predominant position. It is a good thing to remember when undecided. Remember also we own what we advertise—which means that we would not invest in any but GOOD equipment.

Forth-coming pages will discuss 5 Belyea policies one by one. Read carefully for your own guidance, the story behind Belyea RE-NU-BILT Equipment.

1. ANALYSIS OF YOUR PROBLEMS
2. CONSERVATIVE RECOMMENDATIONS
3. CONSISTENT STANDARDS OF REBUILDING & TESTING
4. TIME SAVING DELIVERY SCHEDULES
5. REASONABLE PRICE POLICY

MOTOR GENERATOR SETS

3 phase—60 cycle

1—1500 KW, Whse. 250 v D.C. to 2100 HP, 2300/4600 v syn.

1—1500 KW, G.E. 275 v D.C. to 2100 HP, 2300 v syn.

1—1000 KW, Whse. 600 v D.C. to 1400 HP, 4000 v syn.

1—800 Kva, G.E. 330 KW, 220/440 v A.C. Gen. to 500 HP, 230 v D.C. motor

1—500 KW, G.E., 600 v D.C. to 700 HP, 13200/6600 v syn. with exciter

1—500 KW, G.E., 275 v D.C. to 1000 Kva, 2300 v syn. with exciter

1—400 KW, G.E., 275 v D.C. to 700 HP, 2300 v syn. with exciter

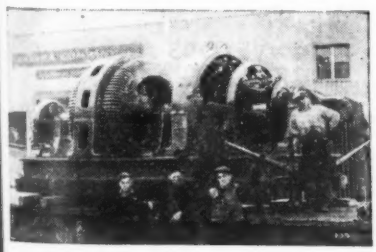
1—75 KW, G.E., 125 v D.C. to 120 HP, 2300/4000 v sq. cg.

1—60 KW, G.E., 125 v D.C. to 75 HP, 2300/4000 v sq. cg.

1—40 KW, Whse. 230 v D.C. to 45 Kva, 2300 v syn.

1—35 KW, Whse. 125 v D.C. to 50 HP, 2300 v sq. cg.

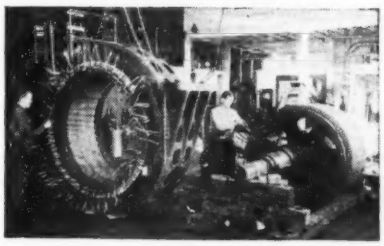
1—25 KW, G.E., 125 v D.C. to 40 HP, 220 v sq. cg.



FREQUENCY CHANGERS

1—75 KW, G.E., with 94 Kva .8 PF, 240 volt, type ATB, 3 phase, 62½ cycle gen. and 125 HP, 440 volt, 3 phase, 25 cycle motor

1—1000 KW, G.E., with 1250 Kva, .8 PF, AQB, 2300 volt, 2 phase (can be changed 800 KW, 3 phase), 58.3 cycle gen. and 1400 HP, .8 PF, 4400/2200 volt, ATI, 3 phase, 25 cycle motor and exciter



A C MOTORS

3 phase—60 cycle

SLIP RING

Qua.	Hp	Make	Type	Volts	Speed
1	1200	Cr. Wh.	801Q	2300	237
2	1000	Whse.	CW	2300	720
1	800	Al. Ch.	ANY	440	885
1	800	Whse.	CW	440	357
2	600	G.E.	IP	440/2200	720
1	500	G.E.	IP	440	600
1	450	Whse.	HF	2200	875
1	400	Al. Ch.	ANY	2300	505
1	400	G.E.	IP	440/2200	600
1	350	G.E.	MT-442Y	2200/4000	253
1	300	G.E.	IM	440	720
1	300	Whse.	CW	440	585
1	250	G.E.	MT-424Y	4000	257
1	200	G.E.	IM	440	600
1	200	Whse.	CW	2200	514
1	150	G.E.	I-17B	2200	290
1	150	Whse.	CW-772C	2200	1160
1	150	G.E.	IM-16	2200	575
1	150	G.E.	IM-17	2200	450
1	100	Whse.	CW-752C	550/440	1160
1	100	G.E.	IM	220	1750

SQUIRREL CAGE

Qua.	HP	Make	Type	Volts	Speed
1	500	G.E.	IK-17B	2200	690
1	300	Whse.	CS	550	580
1	300	G.E.	IK-17B	550/440	600
1	200	G.E.	IK-17B	2200	490
3	175/112	G.E.	Ik-16	440	900/720
1	125	Whse.	CS	550/220	1150
1	125	G.E.	IK	220	720
1	100	G.E.	IK-Vert.	2300	450
1	75	Whse.	CS	550	700
3	60	Whse.	CS-445S	2200	3550

ROTARY CONVERTERS

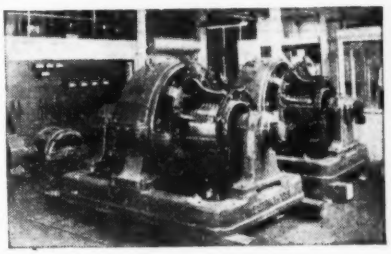
3 phase—60 cycle

Qua.	KW	Make	Speed	DCv	Trans V
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	260	2300
1	1000	G.E.	900	600	13200
1	1000	Whse.	900	600	11000
1	1000	Whse.	720	250	22000
2	750	G.E.	1200	600	2300
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/6600
2	375	G.E.	1200	250	6600/2300

3 phase—25 cycle—Booster Type

1	1500	G.E.	500	225/275	13200/6600
1	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC Panels.



D. C. MOTORS

Qua.	HP	Make	Type	Volts	Speed
2	1250	G.E.	MPC	500	130
1	1200	Whse.	Int.	600	600/720
1	1200	G.E.	MPC	600	450
1	800	G.E.	MPC	550	600
2	625	G.E.	MPC	500	130
1	500	Whse.	Int.	250	250/720
1	500	G.E.	MPC	230	900
2	300	G.E.	DMC	230	400/600
1	300	G.E.	MPC	230	275/550
2	270	Whse.	Int.	500	250/400
1	250	Al. Ch.	Int.	230	525

RE-NU-BILT BELYEA MOTORS

SUCCESSFUL OPERATION GUARANTEED

BELYEA COMPANY INC.

Main Office & Shop: 43 HOWELL ST., JERSEY CITY, N. J.

SPECIAL VALUES FOR JULY

MOTORS

450 H.P. Allis Chalmers 230 volt D.C. Interpole motor 425 R.P.M. 3 pedestal bearings.

230 VOLT DC CONSTANT SPEED

Qu.	H.P.	Make	Type	RPM
1	125	G.E.	DLC	550
1	100	Rel.	1050T	500
1	75	G.E.	DLC	525
2	50	West.	SK160	565
1	40	G.E.	RC15A	700
1	30	West.	SK120	975
2	30	G.E.	RC31B	1150
1	30	West.	SK140	600
8	25	G.E.	RC31	1150
1	25	West.	SK	850
1	20	G.E.	RC11	1150
3	15	G.E.	RC10	1150
5	15	West.	SK 100 I	675
7	15	Rel.	92 T TE.BB	850
2	15	West.	SK90	850
3	10	G.E.	RC29	1150
8	10	G.E.	RC29	350
3	10	West.	SK80	750
2	7½	G.E.	RC	1150
9	5	West.	SK40	850

VARIABLE SPEED

Qu.	H.P.	Make	Type	RPM
1	110	West.	SA	650/1050
1	100	West.	SA	250/350
1	75	G.E.	LC	650/900
2	40	G.E.	LC	650/1300
3	30	West.	SK140	600/1200
1	25	West.	SK	400/1200
1	15	West.	SA9	300/1200
2	15	West.	SK	500/1500
2	10	Al. Ch.		500/1000

SQUIRREL CAGE

Two—250 H.P. G.E. Type I—Form K 1750 RPM 220/440 volt 3 phase 60 cycle.

One—200 H.P. Allis Chalmers squirrel cage 1750 RPM 220/440 volt 3 phase 60 cycle.

220/440 VOLT

Qu.	H.P.	Make	Type	RPM
1	125	Cr. Wh.	125Q	900
1	75	Al. Ch.		600
1	50	Wagner	22 VRM	600
1	50	Gen. Elec.	KT	900
1	40	Rel.		900
5	30	Wagner	19 VRM	720
2	25	Al. Ch.		860
2	20	Al. Ch.		1740
2	20	Rel.	120 AA	900
1	20	Rel.	178 AA	720
1	15	Gent.	SCN 19	1200
1	15	Gen. Elec.	KT	900
3	10	Gen. Elec.	KT	1200
1	7½	Al. Ch.		1150
1	5	Al. Ch.		860
5	1	Wagner	BB	1200

WATER WHEELS and GENERATORS

2—45" HERCULES Cylinder Gate Type B Water Wheels. Complete with Governors, pumps, and tanks. Each direct-connected to a WESTINGHOUSE ELECTRIC Vertical Generator 800 KVA, 3 ph., 600 V. 40 cy. 150 R.P.M.

• • GENERATOR • •
750 KW Ridgway generator 1800 RPM 230 volt D.C.—2 bearing bracket type with base —like new.

• MOTOR GENERATOR SET •
50 KW West. SK150L—1200 RPM 125 volt D.C. connected to 75 HP CS 764—2200 volt 3 phase 60 cycle 1200 RPM motor.

BOILERS

4—1010 HP. Heine Watertube Boilers, pressure 250 lbs., complete with Superheaters, Bethlehem Dahl Oilburners, all valves, Piping and fittings.
2—316 HP. Heine Watertube Boilers 160 lbs. pressure.

STOKERS

UNDERFEED

2—West 7 Retort 750 HP. rated capacity
1—Jones 3 Retort 316 HP. rated capacity.
Steam actuated. Will operate at 200% of rated capacity.

• TURBO GENERATOR •
West. 75 H.P. Turbine non condensing 200 lb. pressure 7200 RPM connected thru reduction gear to 50 KW 125 volt D.C. Generator 1200 R.P.M.

CONDENSER

1—C. H. Wheeler 3650 Sq. Ft. Surface Cond. 2 pass. complete with pumps.

SPEED REDUCERS

6—Jones Herringbone 50 HP. Ratio 93.5 to 1.
1½ HP. G. & F. Worm Gear Type, ratio 10.20 to 1.
15 HP. DeLaval Worm Gear Reduction. Unit ratio 12 2/3 to 1.

WRITE US ABOUT YOUR POWER REQUIREMENTS

TURBO-CENTRIFUGAL PUMPS

Terry Steam driven Turbine centrifugal pump, type GF, turbine 710 H.P., 145 lb. steam pressure, 60 lb. back-pressure, 3581 RPM direct connected thru Gear Unit 1000 RPM; type U Allis Chalmers Centrifugal Pump 18" x 18", 13,000 GPM at 170' head, 1000 RPM.
1—Lawrence Machine 3 stage pump 550 GPM, 416' head. With Elliott Turbine, 200 H.P., 2400 RPM, 170 lbs. initial, 12 lbs. back pressure.
1—Lawrence Machine 8" Circulating Pump. With Lee Turbine, 50 H.P., 2100 RPM, 150-250 lbs. initial, 10 lbs. back pressure.
1—Lawrence Machine 6" Circulating Pump. With London Steam Turbine, 40 H.P., 2200 RPM, 150 lbs. initial, 10 lbs. back pressure.
1—Lawrence Machine 5 stage pump 150 GPM, 635' head. With Lee Turbine, 80 H.P., 2600 RPM, 200 lbs. initial, 10 lbs. back pressure.
1—Lawrence Machine 5 stage pump 200 GPM, 635' head. With Lee Turbine, 85 H.P. 2650 RPM, 175 lbs. initial, 10 lbs. back pressure.

PUMPS OR TURBINES MAY BE PURCHASED SEPARATELY

CENTRIFUGAL PUMPS

2—Lecourtenay 5" all bronze centrifugal pumps 500 GPM at 90' head direct connected to Allis-Chalmers 20 H.P. Motor 440, 60, 3, 1740 RPM.
2—Lecourtenay 12" Iron Casing Motor Driven Centrifugal Pumps, type 12BT8, 5,000 GPM at 148' H., Direct connected to G.E. 250 HP. Motor, type IE15, form K, 440, 60, 3, 1760 RPM.
Lecourtenay 12" Iron Casing Motor Driven Centrifugal Pump, 4,500 GPM at 135' H. 1750 RPM Direct Connected to Allis-Chalmers 200 H.P. Motor 440, 60, 3, 1750 RPM.
8—Gould Centrifugal Pumps 270 GPM, 30' H. Direct Driven by 5 H.P. A.C. Motor.
Cameron Centrifugal Purchased New 1923. Bronze fitted, mounted on common sub-base for motor drive—
1—Size 14—700 RPM 4700 GPM 35' head 60 H.P.
1—Size 14—720 RPM 5580 GPM 30' head 75 H.P.
1—Size 16—350—RPM 3500 GPM 45' head 125 H.P.
All Pumps Tested Hydrostatically for 125 lbs.
All Double Suction Volute, Gate Valves Attached.
1—Gould Triplex Pump 5 x 8.

CONVEYORS AND BUCKET ELEVATORS

MISCELLANEOUS

3—100 KVA Pittsburgh 2400/240/120 oil.
4—5 KVA Weghse. 2300/230/460 air.
FEEDWATER HEATER: 5,000 HP. Cochrane open type.
50 KW Westinghs. 125 V. DC. 900 RPM. direct conn. to 75 HP. 440-3-60 Motor.
OVERHEAD CRANES: One 25 Ton overhead hand-operated.
One 15 Ton overhead 50' span traveling crane, electric lift; hand travel.

Special • • TURBO-GENERATOR • • Special

6250 KVA Westinghouse Turbo-Generator Set: Turbine 3600 RPM, 200 lbs pressure, 125° Superheat, complete with condenser, Pump and Air Washer. Generator: 6250 KVA 3 Phase 60 Cycle 2300 Volt 3600 RPM with turbo exciter and Motor Generator Exciter.

HEAT and POWER Company

45 BOND STREET — Phone: Algonquin 4-3874 — NEW YORK 12, N. Y.

REBUILT POWER EQUIPMENT

READY TO SHIP!

MOTOR GENERATOR SETS

1—150 KW Ridgway 250 v. 900 rpm. 2200 v. 3 ph. 60 cy. syn.
1—300 kw. West. 550 v. DC 1200 rpm. 2200 v. 3/60 complete with AC and DC swb; also automatic reclosing circuit breaker.

25 CY. MOTORS—220/440 V. A.C.

HP	Make	Type	RPM
40	Al. Chal.	AN	750
35	G.E.	I-M	500
30	G.E.	KF	1475
25	Westg.		750
20	G.E.	KF	
1	Westg. (vert.)	CSA	750

SLIPRING MOTORS—3 PH., 60 CY.

H.P.	Make	Volts	R.P.M.	Type
5	G.E.	440	1200	MT
20	Westg.	220	1735	CW
20	Cr. Wh.	220	850	
20	G.E.	220	1200	MT
40 to 50	Westg.	440	1150	CW
50	G.E.	220/440	1160/560	OM-7
50	Westg.	440	1150	CW636A
50	Westg.	440	1145	HF
50	Chandeys'n	220/440	1800	
50	G.E.	220/440	1200	HI
50	Allis Chal.	220	490	
62	Westg.	220/440	1135	
75	Westg.	220/440	690	CW
75	G.E.	440	1800	ITC-M
75	G.E.	220	900	
100	Westg.	2200	900	CW
100	G.E.	2200	450	I-M
100	Westg. (Ball Bearing)	220	720	CW-854
150	G.E.	220	375	I-8
185		2300	900	
200	Westg.	220/440	580	CW
260	Burke	440	600	EMV-65
300	G.E.	440	900	I
300		2300	720	
400	Westg.	2300	580	CW
400	Westg.	2200	435	CW-1214
600	G.E.	550	150	I
600	G.E.	2200	600	MT-12
1500	Westg.	2200	435	CW

ALTERNATING CURRENT MOTORS

3 ph. 60 cy.

H.P.	Make	Volts	R.P.M.	Type
30	Westg.	220	1120	CX
30	G.E.	220 only	900	I
30	Triumph	220	1200	B11
30	Linc. Elec.	220	600	
30	Duquesne	440	600	
30	Allis Ch.	220	900	
30	Triumph	220	525	TR-138
30	Western	220	900	
30	Allis Chal.	220/440	1200	
30	G.E.	220/440	900	KT-532
30	G.E.	220/440	1750	KF
35	West.	220/440	1200	CS
35	Lincoln	220	720	
35	G.E.	440	1200	I
35	Al. Ch.	550	1200	
40	Howell	220	900	SO
40	Reliance	440	900	
40	Linc. Elec.	220	900	
40	Westg.	440	900	C
40	Al. Ch.	440	720	
40	Westg.	440	600	C
40	Westg.	220	514	CS
40	G.E.	220/440	1160	K
40	Duquesne	220/440	850	
40(New)	West.	220/440	1800	CS
40	G.E.	220/440	1200	KT-532
40	West.	2200/220/440	514	CS
40	West.	220/440	900	CE
50	Fair Morse	220	900	
50	West.	2200/220/440	360	CS-954
50	West.	2200	575	CS
50/150	West.	2200	360/720	CS-954
50	Westg.	440	1800	C
50	Western El.	220	570	KT-346
50	Chandeys.	220/440	1800	
50	Duquesne	440	1200	
50	Allis Chal.	440	1800	AN
50	West.	440	1120	C
50	Westg.	220	600	CS-752C
50	G.E.	220/440	1200	HI
50	Westg.	440	690	C
50	Allis Chal.	2200	865	
50/32	G.E.	440	800/640	
50/60	G.E.	440	1200	I
54	Allis Chal.	440	900	
60	Westg.	440	1800	C
60	Duquesne	440	1800	
60	Al. Ch.	440	1200	
60	Westg.	220	720	CS
60	Allis Chal.	440	1800	AN
75	West.	220/440 (Linestart)	3550	CS-W4458
75	Louis Allis	220/440	1770	505Y
	Adjusto speed—splash proof—ball bearing			
75	G.E.	220/440	1150	I-8
75	G.E.	220	900	I-8
75	West.	2220/220/440	720	CS
75	G.E.	440	1165	
100	Allis Chal.	220	1750	
100	West.	2220/440/220	600	CS-954
100	G.E.	2200	450	I
100	Allis Chal.	220	600	
100	G.E.	440	400	I-K
125	West.	2300	1170	CS
125	G.E.	440	450	I
125	G.E.	220/550	400	I
150	West.	220/440	327	Syn.
150	West.	2200	720	CS-954
150	Wagner	440	1800	31V
150	G.E.	440	514	I
150	G.E.	220/550	450	I
150	G.E.	550	575	I-K
150	G.E.	2200/220/440	450/243	
150	Westg.	2200	327	LC-Syn.
50/150	West.	2200/440/220	360/720	CS
(Complete with Nites Speed Reducer, ratio 10:1)				
175	G.E.	2200	600	I-12
200	Westg.	440	1700	CS
200	Westg.	2200	900	
200	G.E.	220/500	514	I
200	West.	2200/440/220	900	CS-954
400	West.	2200/220/440	500	CS
500	G.E.	220/440	1170	KTP-567
1000	G.E.	2300	509	K
1500	G.E.	2200/220/440	225	ATI-Syn.
2000	G.E.	2200/220/440	240	TS-Syn.
3500/4000	Wrst.	4000/23000	900	Syn.
9000	G.E.	6600	107	ATI

VARIABLE SPEED MOTORS—230 VOLT D.C.

H.P.	Make	R.P.M.	Type
½	Reliance	550/2000	
⅓	Northern	700/2000	
1	Westg.	300/600	SK-53
1½	Westg.	740/2200	SK-10
1½	Reliance	500/1000	14T
2	G.E.	400/1600	
2	G.E.	415/830	R1C
2	G.E.	500/2000	
2¼	Westg.	450/900	SK-30
2½	G.E.	500/1000	RLC
2½	Reliance	500/1000	14T
2½	West.	600/1200	SK-30
2¾	Westg.	900/1800	SK
3	Jantz-Liest	650/1950	BI-DC
3	Westg.	450/900	SK
3	Roth (Enclosed)	500/1000	RS
3	West.	650/1950	SK-33
3	West.	850/1700	SK-33
3¼	West.	400/1600	SA
3½	Westg.	850/1700	
3½	Reliance	300/600	
5¾	West.	100/1600	SK-110L
5	Allis Chal.	450/1800	E-90
5	Reliance	300/1800	21
6	Roth	500/1000	RS
7½	Westg.	450/900	80L
7½	Reliance	650/1300	550v.
7½	Westg.	1125/2905	SK-43
7½	West.	400/1600	SK-100L
7½	West.	400/1600	SA
10	Westg.	565/1130	S-6
10	G.E.	625/1250	LC
10	West.	400/1600	SA
10	West.	400/1600	SK-100L
10	West.	850/1700	SK-70
10	West.	500/1000	SK-70L
15	Louis Allis	1150/1750	NA
15	Reliance	500/1800	
15	West.	850/1700	SK-90
15	West.	675/1350	SK-100L
20	Westg.	900/1800	SK-100L
20	G.E.	270/540	
20	Westg.	750/1500	SK-110L
20	Westg.	750/1125	SK
30	G.E.	450/900	RLC
35	G.E.	375/1400	IC
50	G.E.	600/1200	500 v.
75	West.	475/950	SK-180
75	West.	400/650	SK-181

TRANSFORMERS—1 ph. 60 cy.

No.	Kva.	Pri. Sec.	Make	Ph.
5	2	1040/2080	115/230	G.E.
1	3	4160/2400	120/240	G.E.
1	3	2400	120/240	G.E.
1	3	1040/2080	115/230	G.E.
1	3	2200	220/440	West.
1	2	2200	110/200	G.E.
1	2	440	110/220	Westg.
1	3	2400/4100	120/240	G.E.
1	3	2400	120/240	G.E.
15	5	220	110	G.E.
45	5	1100/2200	122/244	G.E.
21	5	2200/1100	110/220	West.
87	5	2200/1100	110/220	G.E.
101	7½	2200/1100	110/220	G.E.
43	7½	2200/1100	110/220	West.
50	7½	1100/2200	122/244	G.E.
27	7½	220	110	G.E.
30	7½/10	440	110/220	G.E.
19	10	2200/1100	110/220	West.
48	10	2200/1100	110/220	G.E.
42	10	1100/2200	122/244	G.E.
45	10	220	110	G.E.
2	15	400/30000/50000		Amer.
45	15	440	110/220	G.E.
15	15	4160	110/220/440	G.E.
12	15	2200	110/220/440	G.E.
27	20	2200	110/220/440	G.E.
30	20	4160	110/220/440	G.E.
1	25	460	180	Pgh.
1	25	1100/2200	110/220	G.E.
1	37½	2300	110/220	Wag.
3	50	6600	575	G.E.
3	50	6600	575/440/220	G.E.
4	50	6600	575/440	Allis.
4	60	11430/6600	550	Al Ch.
6	73	440	220	West.
6	73	440	205	West.
1	75	2200	220—3 ph.	Burke
3	100	6600	220/440/550	Pgh.
1	100	2200	110/220—3 ph.	G.E.
1	140	2300		
Furnace Trans. 60-80 and 100 v. taps.				
1	150	2200	110/220	G.E.
1	200	2200	110/220	G.E.
1	250	11000/22000	110/220/440	Pgh.

INDUSTRIAL TRUCKS

1—Baker Tow Truck with batteries.

CHAIN BLOCKS—with or without trolleys

2—Chisholm Chain Blocks 2 tons
2—Ford Triblock—2 ton
4—Ford Triblock—3 ton
1—Phila.—3 ton

HOISTS

2—New Shaw Monorail Load Lifters—2000 lbs.—25' lift, 2 HP, A.C. Motors, push button control
1—2 ton Shepard 250 v. D.C. complete with trolley and cable
1—3 ton Westinghouse Hoist with Westinghouse DC Motor, 1600 rpm.

INDUCTION MOTOR GENERATOR SETS

250 Volts Compound Wound, D. C.—3 Ph., 60 cy. Motors

KW	Make	RPM	AC volts
2	Crocker Wheeler	1750	220/440
3	Westinghouse	1150	220/440
5	Allis Chalmers	1150	220/440
7½	Allis Chalmers	1150	220/440
25	Westinghouse	1150	220/440/550
10	General Electric	1150	220/440
15	Westinghouse	1150	220/440
20	Westinghouse	1150	220/440
30	West.	1150	220/440
35	G.E.	1150	220/440
35	Westinghouse	850	220/440
40	West.	1150	220/440
90	Reliance	1150	220/440
110	Crocker Wheeler	720	2200/440/550
75	Westinghouse	435	2200
75	Westinghouse	435	440/220

COAL CONVEYOR

Link Belt Vertical Coal Conveyor, bucket type, approx. 80 ft. good for 100 FPM, hoists 25 TPH, all new buckets and gears complete with 20 HP AC motor.

D.C. CLARK CONTROLLER

1—250 HP Clark Vari-time magnetic controller 230 v. DC reversing, used for plugging service. Can also be used non-reversing.

GEAR MOTOR

20 HP Louis Allis Gear Motor, 220/440 v. 3 ph. 60 cy. 1750 rpm. with speed reducer motorized planetary speed reducing transmission, driven speed approx. 14 rpm. totally enclosed, fan cooled.

A.C. GENERATORS

125 KVA West., 220/220/440 v., 3 ph., 60 cy., 327 rpm.
150 KVA Wagner, type BF, 600 rpm., 400 v., 3/60.
250 KW Al. Ch., 480 v., 150 rpm., 3 ph.
360 KVA West. 220 v., 3 ph., 60 cy., 360 rpm.

SPEED REDUCERS

H.P.	Make	Ratio	R.P.M.
1/4	Boston	39:1	720
1/2	Boston	39:1	900
3/4	Boston	39:1	1200
1	Boston	39:1	1800
1	Boston	30:1	720
2	Boston	30:1	900
3	Link	22:1	870
3	Boston	30:1	1200
5	Boston	30:1	1800
25	W. A. Jones	9.143:1	300
40	W. A. Jones	9.143:1	480
50	W. A. Jones	9.143:1	575
50	Niles	10:1	
50/150	Niles	10:1	360/720
75	W. A. Jones	9.143:1	875
75	Niles	10:1	350
100	W. A. Jones	9.143:1	1150
100	Niles	10:1	550
125	Niles	10.1	600
150	Niles	10.1	720
175	W.A.Jones	9.143:1	1750
200	Niles	10:1	860
225	Nuttal	1.6:1	
300	Niles	10:1	1150
300	Nuttal	1.6:1	
400	Niles	10:1	1750
400	Nuttal	1.6:1	

Large Stock—CIRCUIT BREAKERS—METERS — CURRENT AND POTENTIAL TRANSFORMERS—POTHEADS—RELAYS—METERS — SAFETY SWITCHES — DISCONNECT SWITCHES — U-RE-LITES — PULLEYS — REACTORS.

WRITE, WIRE OR PHONE YOUR ELECTRICAL REQUIREMENTS—SEND FOR STOCK LIST.

LIST YOUR IDLE EQUIPMENT WITH US.

DUQUESNE ELECTRIC & MFG. CO.

PITTSBURGH 6, PA.

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.

1—15300 KVA Westinghouse Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 3125 KVA Westinghouse Cond.
1— 2500 KVA Westinghouse Cond.
1—1563 KVA General Electric Cond.
1— 1563 KVA Westinghouse Extrac.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 938 KVA West. 375# I.P. 100# B.P. N-C.
1— 625 KVA General Electric Non-C.
1— 500 KVA Westinghouse Non-C.
1— 470 KVA Westinghouse Non-C.
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.
1— 107 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.

1—1067 KVA Nordberg Uniflow
1— 375 KVA Nordberg Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 210 KVA Skinner Uniflow
1— 187 KVA Skinner Uniflow
1— 150 KVA Skinner Uniflow
1— 100 KVA Skinner Uniflow
1— 94 KVA Ridgway 4-valve
1—93.8 KVA Skinner Uniflow
1— 60 KVA Skinner Uniflow

D. C. STEAM ENGINE UNITS

1—425 KW Ridgway 4-valve 275 V.
1—400 KW Ridgway 4-valve 275 V.
1—350 KW Ridgway 4-valve 250 V.
1—300 KW Skinner Uniflow 250 V.
1—250 KW Ames Uniflow 250 V.
1—150 KW Ridgway 4-valve 125/250 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire
1—100 KW Elliott 4-valve 250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.

1—625 HP Worthington, 240 V. gen.
1—610 HP Campbell, 2400 V. gen.
1—600 HP West. (gas), 480 V. gen.
1—520 HP Busch Sulzer, 2400 V. gen.
1—375 HP Worthington, 240 V. gen.
1—360 HP Anderson, 2300 V. gen.
1—360 HP Fair.-Morse, 2400 V. gen.
1—300 HP Worthington, 2300 V. gen.
1—283 HP Coop.-Bess., 230 V. gen.
1—175 HP Sterling (gas), 480 V. gen.
3—160 HP Coop. Bess., 216 V. gen.
1—145 HP Superior, 220 V. gen.
1—57.5 HP Caterpillar, 120/208 V. gen.

SURFACE CONDENSERS

1—20,000 sq. ft. Worthington
1—12,000 sq. ft. Worthington
1— 5,000 sq. ft. Westinghouse
1— 4,100 sq. ft. Ross
1—2,310 sq. ft. Wheeler C. & E.

WATER TUBE BOILERS

1—850 HP B. & W. 250-lb., Stoker
1—750 HP Edge Moor 200-lb.
2—612 HP Stirling 200-lb., Stokers
1—600 HP Union 250-lb., Stoker
5—600 HP B. & W. 200-lb., Stokers
2—560 HP Erie City 460-lb.
2—512 HP Stirling 205-lb.
1—335 HP B. & W. 200-lb.
2—300 HP Heine 200-lb.
2—300 HP B. & W. 160-lb.
4—200 HP B. & W. 200-lb., Hand Fired

A. C. GENERATORS

2—1500 KVA G. E. 25 cy. 2200 V. 750 RPM
2—1250 KVA G. E. 60 cy. 480 V. 750 RPM
1— 750 KVA G. E. 60 cy. 230-460 V. 300 RPM
1— 680 KVA G. E. 25 cy. 13200-4000 V. 300 RPM
1— 500 KVA G. E. 60 cy. 2300 V. 360 RPM
1— 360 KVA West. 60 cy. 240 V. 360 RPM
1— 94 KVA G. E. 60 cy. 2300 V. 600 RPM
1— 48 KW Elec. Mcy. 60 cy. 2400 V. 1200 RPM

SYNCHRONOUS MOTORS

2—1250 HP G. E. 25 cy. 2200 V. 750 RPM
2—1125 HP G. E. 60 cy. 480 V. 720 RPM
1— 850 HP G. E. 25 cy. 13200-4000 V. 300 RPM
1— 800 HP G. E. 60 cy. 440 V. 120 RPM
1— 770 HP G. E. 60 cy. 230-460 V. 300 RPM
1— 620 HP G. E. 60 cy. 440 V. 164 RPM
1— 150 HP West. 60 cy. 2200 V. 600 RPM
1— 100 HP G. E. 60 cy. 2300 V. 240 RPM (Super)

INDUCTION MOTORS—60 Cy.

4—3500 HP G. E. slip ring 2300 V. 120 RPM
1—1000 HP G. E. sq. cage 2300 V. 509 RPM
1— 600 HP G. E. sq. cage 440 V. 900 RPM
2— 400 HP G. E. slip ring 3800 V. 1800 RPM
2— 300 HP G. E. sq. cage 440 V. 600 RPM
2— 250 HP G. E. sq. cage 2300/4000 V. 1200 RPM

MOTOR GEN. SETS—60 Cy.

1—1500 KW Allis Chalmers 600 V. DC
1—1000 KW General Electric 600 V. DC
1—1000 KW Westinghouse 250 V. DC
1— 75 KW General Electric 125 V. DC
2— 75 KW Westinghouse 125 V. DC

ROTARIES—60 Cy.

1—1500 KW Westinghouse 250 V.
2—1000 KW Westinghouse 250 V.
2— 750 KW General Electric 600 V.
1— 750 KW Westinghouse 225/275 V.
1— 500 KW General Electric 250 V.
1— 500 KW General Electric 600 V.

FREQUENCY CHANGERS

2—12500 KW G. E. 60/25 cy. 300 RPM
2— 5000 KVA West. 25/60 cy. 300 RPM
2— 3125 KVA West. 25/62½ cy. 750 RPM
1— 2500 KVA West. 25/60 cy. 300 RPM
1— 1875 KVA G. E. 25/60 cy. 300 RPM
2— 1250 KVA G. E. 25/62½ cy. 750 RPM
1— 1250 KVA G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 60/25 cy. 300 RPM

SYN. CONDENSERS—60 Cy.

1—5000 KVA West. 5000 V. 720 RPM
1—2000 KVA C. W. 11000 V. 600 RPM
2—1250 KVA G. E. 480 V. 720 RPM
1— 750 KVA G. E. 230-460 V. 300 RPM
1— 500 KVA West. 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.

1—10000 KVA West. 120,000/66000-13200 V. 3 ph.
3— 2500 KVA Pitts. 6600-25400/12700 V.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
3— 750 KVA Pitts. 66000/33000 V.
3— 200 KVA G. E. 66000-13200/22800 V.
6— 250 KVA Penn. 34500-4600/2300 V.
4— 150 KVA Pitts. 33000-2300/4600 V.
3— 75 KVA G. E. 33000-13200/11000 V.
1—15000 KVA Al. Ch. 27880-4560 V. 3 ph.
2—10000 KVA West. 26400-4580 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
1— 6000 KVA West. 13200-2300 V. 3 ph.
2— 1000 KVA G. E. 23000/11500-575 V.
3— 833 KVA G. E. 22000-2300/4000 Y V.
3— 667 KVA Packard 23000-440 V.
3— 250 KVA G. E. 22000-11000 V.
6— 1667 KVA Pitts. 13200-2300 V.
5— 1000 KVA G. E. 13200-2300 V.
3— 200 KVA G. E. 13200-2300 V.
7— 667 KVA Moloney 11000-2300 V.
3— 150 KVA Pitts. 11000-2400 V.
3— 100 KVA West. 11000-230/125 V.
3— 1250 KVA G. E. 6600-550 V.
3— 150 KVA Al. Ch. 2400/4800 V.

VOLTAGE REGULATORS

60 Cycle Induction

6—96 KVA 400 A. 2400 V. Gen. Elec.
1—72 KVA 300 A. 2400 V. Gen. Elec.
2—48 KVA 200 A. 2300 V. West.
6—36 KVA 150 A. 2400 V. Gen. Elec.
6—24 KVA 100 A. 2400 V. Gen. Elec.

OIL CIRCUIT BREAKERS

2— 400 A. 73 KV G. E. FKO36 Outdoor
1— 400 A. 73 KV G. E. FHKO36 Outdoor
1— 800 A. 37 KV G.E. FHKO136 Outdoor
5— 400 A. 37 KV G. E. FHKO136 Outdoor
4— 400 A. 34.5 KV Condit D-16-A. Outdoor
2—1000 A. 30 KV Kelman CB76 Outdoor
4— 600 A. 15 KV G. E. FKO60B Outdoor
2— 400 A. 15 KV G. E. FHKO136 Outdoor
2— 600 A. 25 KV West. B-13 Indoor
1—2000 A. 15 KV West. E6 Indoor
1—1500 A. 15 KV West. E6 Indoor
2—1500 A. 15 KV G. E. FK12 Indoor
3— 600 A. 15 KV G. E. FK32G Indoor
6—1200 A. 4.5 KV Condit D-12 Indoor
2—1000 A. 4.5 KV Condit D-12 Indoor

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PUMPS

G.P.M.	Head	Make	Type
9700	110'	Ing. Rand	Centrif.
6000	33'	LeCourtenay	Centrif.
3500	140'	Kingsford	Centrif.
2500	150'	Goulds	Centrif.
1500	180'	Penna.	Centrif.
400	625'	LeCourtenay	Centrif.
250	525'	LeCourtenay	Centrif.
300	500'	Goulds	Triplex
175	500'	Worth.	Teiplex
500	175'	Blackmer	Rotary
450	231'	Kinney	Rotary
300	150'	Viking	Rotary
200	175'	Blackmer	Rotary
1000	460'	Knowles	Steam
600	460'	Knowles	Steam
2000	50'	Lawrence	Sump
300	231'	Gardner	Plunger

GENERATOR SETS BOILER FEED PUMPS

K.W.	Make	Volts	Type
25	Green Eng.	220	Belt Drive
17	Sturt. Turb	110	Direct Drive
7½	Sturt. Turb	110	Direct Drive
5	Kohler Gas	110	Direct Drive

MOTORS (D. C.)

100 Northwest 220 1750
25 Imperial 220 450

STORAGE TANKS

5 to 3000 gal. Steel Welded
5 to 1000 Gal. Steel Press.
15 to 300 Gal. Conden. Tanks

CONDENSATION RETURN UNITS

Nash-Jenn Dup. Vac. Heat. 28000EDR
Nash-Jenn Sump Vac. Heat. 16000EDR
Condensation Units 100 to 250,000EDR

AIR COMPRESSORS

C.F.M.	Pressure	Make	Type
850	100	Laidlaw	Hor. Dup.
500	60	Ind. Rand	Steam
400	125	American	Horiz.
350	40	Worthing	Horiz.
250	100	Sullivan	Horiz.
220	100	Gardner	Gas Eng.
28	5000	Norwalk	4-Stage

TURBO-CENTRIFUGAL BLOWERS

3000	16 lbs.	In. Rand	Motor dr.
3000	8 lbs.	In. Rand	Motor dr.
2300	3 lbs.	Spencer	Motor dr.
950	24 oz.	Spencer	Motor dr.
900	5¼ lbs.	In. Rand	Motor dr.
700	2½ lbs.	Allen Billmyer	Motor dr.
675	24 oz.	Spencer	Motor dr.
250	16 oz.	Spencer	Motor dr.

BLOWERS

C.F.M.	St. Pres.	Make	Type
100–60000	½"–5"	Buffalo	Various
100–15000	¼"–16 oz.	American	Various

ROTARY PRESSURE BLOWERS

C.F.M.	Press	Make	Type
10000	2 lbs.	Roots	Belt dr.
6000	3 lbs.	Roots	Belt dr.
3000	3 lbs.	Roots	Belt dr.
2000	3 lbs.	Sturt.	Belt dr.
1000	3 lbs.	Roots	Belt dr.
200	5 lbs.	Baker	Dir. dr.
110	15 lbs.	Beach R.	Belt dr.

VACUUM PUMPS

1000	15 in.	Roots	Belt dr.
350	27 in.	Worth.	Belt dr.
300	27 in.	Nash	Belt dr.
100	27 in.	Deane	Belt dr.
200	29 in.	Devine	Belt dr.

MOTORS (3 ph. 60 cy.)

H.P.	Make	Volts	Speed	Type
300	G.E.	2300/4000	1800	Syn
175	G.E.	440	1150	I
100	Lincoln	220	1750	
50	Wagner	220	850	Syn. 2 ph
50	G.E.	2300	1750	I
50	West.	220	850	CCL
50	West.	220	570	CS
40	G.E.	220	870	342
30	G.E.	220	1750	312
30	Wagner	220	850	si. rg.
30	Wagner	220	1150	

STEAM ENGINES

Turb. Cent. Bronze Pumps
Valves—Reducing Valves
10"x10" Greenfield Vertical
7"x7" Wickes Bros. Vertical
6"x6" Lawrence Vertical
1 to 40 H.P. Steam Turbines

SIMILAR EQUIPMENT IN STANDARD MAKES AND SMALLER SIZES
HIGHEST PRICES PAID FOR YOUR IDLE EQUIPMENT

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STEAM PUMPING ENGINES

1—Snow 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20-40x14¾x36, with waterworks type cond.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 12x28x13x24. Fine cond.

PUMP VALVES

Birch Valves for all types of reciprocating pumps.

LARGE GATE VALVES

1—20" Rensselaer #13 Iron Body Bronze Mounted Hub End Gate Valve with 16" Iron Brass Lined Hydl. Cyl. with indicating Rod and Eyebolt, 100#
1—20" Crane 125# Flanged Hand Wheel operating Gate Valve.

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GOOD VALUES — ALWAYS

35 ton Plymouth Std. Gauge Gas Loco.
25 ton American Loco. Crane, for rent.
56 HP Climax Gaso. Power Unit.
35 HP Clyde DD & Swinger Gas Hoist.
20 ton American 100' Boom Guy Derrick.
80 & 150 HP Steel Cased HRT Boilers.
80 HP Vertical Erie City Boilers.
500 and 800 KW Uniflow Units.
180 & 270 HP Worthington 2300 V Diesels.
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8x12" Ides Ideal 50 KW, 2300 V Steam Gen.
13x21" Buckeye, 11x10" Bates, Steam Engs.

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IMMEDIATELY AVAILABLE

1—1875 KVA Gen. Elec. Generator 3/60/2300—3600 RPM, 80% PF, type ATB-2-1875-3600, form T. 1500 KW. Curtis Turbine, three stage, 3600 RPM, form C. 200# St. Pres., Condensing 16.8 # ST. per KWH.
2—650 KVA Gen. Elec. Generators 3/60/2300—3600 RPM, 70% PF, type ATB-2-650-3600, form T. Curtis Turbines, four-stage, 3600 RPM, form G. 190# St. Pres., Condensing, 23# ST. per KWH.

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ROSLYN 1220

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1—400 KW, 250 V. DC Gen. D/C Skinner Unaflow
1—375 & 625 KVA Dir. Con. Eng.-Gen. Sets
1—600 HP, 250# WT Boiler; 100 HP Loco. Type
2—25 HP Crane Motors; 50 HP Variable Speed
4—100 HP Sq. Cage Motors; 125 HP Synchronous
1—290 HP Gasoline Eng.; 130 HP HRT Boiler
2—150, 750, 360 & 60 HP Fuil Diesels
1—1800 sq. ft. Closed Feed Water Heater

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List equipment you want to sell with us. Our available equipment list includes a complete diesel plant consisting of three 160 HP—240 volt units and many other items.

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HOWARD BLAINE JOHNSON & ASSOCIATES
53 W. Jackson Blvd., Chicago 4, Illinois.

1—400 HP Westinghouse, type CW, 3 ph. 60 cy, 440V, 450 RPM slip ring motor
1—250 HP General Electric, 3 ph, 60 cy, 440V, 1-17 400 RPM
1—150 HP Electric Mach. syn. motor, 125 KVA, 3-60-220V, 1200 RPM
1—150 HP General Electric, 3-60-440V frames 17A 360 RPM slip ring
1—150 HP Westinghouse, 2 ph, 60 cy, 440V frame 1000, CW. 390 RPM slip ring
4—100 HP General Electric, 3-60-440V, 495 RPM, MT 562 slip ring
2—100 HP General Electric type I, form K, 3-60-220V 575 RPM

2—800 HP, 3 PH, 60 CY, 6600 V Westinghouse, type CW, slip ring 507 RPM mill type motors with liquid slip regulators.

1—150 HP DC Westinghouse, type SK, frame 666.3, 600 V, 360/720 RPM ped. type mill motor, #4798360.

1—100 HP Westinghouse, type CCL, 3 ph, 60 cy, 2200V, 1750 RPM, Squirrel Cage
1—100 HP Allis-Chalmers, type ANY, 3 ph, 60 cy, 220V, 580 RPM slip ring
1—100 HP General Electric, 3 ph, 60 cy, 4000V, 720 RPM syn., type TS with direct connected exciter
2—100 HP Crocker Wheeler, size 2AQ, 3 ph, 60 cy, 440V, 385 RPM slip ring
1—100 HP Westinghouse, type CS, 3 ph, 60 cy, 440V, 1750 RPM sq. cage
2—75 HP 300 foot head Pumps: 2200V Fairbanks-Morse, 1800 RPM 3 ph, 60 cy, slip ring motors direct connected to 500 GPM 3 stage
1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V 450 RPM slip ring
1—75 HP Fairbanks-Morse, type H, frame 165C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage
1—75 HP Lincoln, type IQ, 2 ph, 60 cy, 440V, 600 RPM Squirrel Cage
1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 600 RPM slip ring
1—75 HP Western Elec. type I, 3-60-440V, 690 RPM
2—75 HP Allis Chalmers, 3 ph, 60 cy, 440V, 860 RPM slip ring
1—60 HP Lincoln 3-60-220V frame IXM, Sq. Cage, 900 RPM
1—60 HP General Electric, 3-60-440V, 720 RPM, type I, form K
1—60 HP General Electric, 3-60-440V, 1750 RPM, type I slip ring
1—60 HP Westinghouse, 3 ph, 60 cy, 220V, 1160 RPM, type CS-644C
1—50 HP Wagner (Fynn Weichsel) 3-60-440V, 1200 RPM
1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring

2—G.E. factory built syn. M-G sets 230 KW, 125 V, 600 RPM generator driven by 335 HP, 4600 V syn. motor complete with starting equipment and panels.

1—50 HP Triumph 3-60-440V, type C12, 1150 RPM, slip ring, rotor & stator rewound
1—50 HP General Electric, 3-60-440V, 900 RPM, type I-M, slip ring
1—50 HP General Electric, 3-60-440V, 720 RPM, type IK, Sq. Cage
2—50 HP Allis-Chalmers 3-60-440V, 690 RPM slip ring
1—50 HP General Electric 3-60-440V, 690 RPM, MTS 46, slip ring
1—50 HP Ideal 3-60-440V, 580 RPM, type AV, slip ring
1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage
1—50 HP Allis-Chalmers, 3-60-440V, 490 RPM, Sq. Cage
1—50 HP General Electric 3-60-440V, 490 RPM, type I-M, slip ring
1—50 HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage
1—50 HP Howell, 3 ph, 60 cy, 440V, 1165 RPM, type SC50-4, ball bearing
1—50 HP Allis-Chalmers, 3 ph, 60 cy, 550V, 860 RPM sq. cage
1—50 HP General Electric, type I-M, 3 ph, 60 cy, 440V, 720 RPM slip ring
1—45 KVA Fairbanks Morse, 3 ph, 60 cy, 220V, 1200 RPM alternator
2—30 HP Fairbanks-Morse, 3 ph, 60 cy, 2220V, 3600 RPM, type HO, frame 12B ball bearing

2—drag generators, 15 KW, Westinghouse, SK111, 125 V, 450/1800 RPM gear head, ratio 10 to 1, used a few months.

2—175 HP, 230V, DC Westinghouse, type SK, 150 to 550 RPM
1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM
1—60 HP Westinghouse, type SK140L, 115V, 1150 RPM vertical
1—50 HP Westinghouse SK200, 230V, 250/900 RPM
2—40 HP C & C 230V, 250/1000 (planer)
2—40 HP, G. E., 3 ph, 60 cy, 440V, 435 RPM, type I-13A

25 CYCLE MOTORS

1—50 HP Westinghouse 3-25 cy-440V, 720 RPM, type MS, Sq. Cage
1—50 HP General Electric, 3-25 cy-440V, 700 RPM, type I-M, slip ring
1—40 HP Westinghouse 3-25 cy-440V, 730 RPM, type CI, frame 753A slip ring crane
1—35 HP Allis-Chalmers 3-25 cy-440V, 720 RPM, slip ring
1—30 HP Westinghouse 3-25 cy-440V, 720 RPM, CS. Sq. Cage

The Wente Electric Co.,

Hamilton, Ohio

REBUILT MOTORS & GENERATORS SINCE 1906

Wagner "Certified Rebuilt" Electrical Apparatus

QUICK SHIPMENT—Partial Listings—Send for Complete Catalog!

SQUIRREL CAGE MOTORS

3 Phase—60 Cycle—220 or 440 Volts

Qua.	HP	Mfr.	Type	Speed
1	250	G.E.	I-K	900
1	150	Gen. Elec.	I-K	1200
1	150	Cr. Wheeler	126Q	600
1	125	Whse. b.b. 2200 v.	CS771C	1800
1	100	Allis Ch.	AN	1800
1	100	Gen. Elec. 2200 v.	IK-15	720
1	100	Allis Ch.	AN	600
2	100	Gen. Elec.	KT356	900
2	75	Allis Ch.	AN	720
1	75	Whse.	CCL	720
1	75	Gen. Elec.	I-K	600
1	75	Gen. Elec.	KT343	1200
1	50	Wagner	22TBP	1200
2	50	Howell b.b.	NC505	900
1	50	Allis Ch.	AN	514
2	50	Gen. Elec.	KT336	1200
2	50	Gen. Elec.	KT542	900
1	40	Wagner	19TRM	1200
1	40	Whse.	CX	600
1	40	Gen. Elec.	I-K	1200
2	40	Fair Morse b.b.	H12C	900
2	40	Allis Ch.	AR420	900
6	30	Allis Ch.	AN	1200
1	30	Allis Ch. b.b.	AR220	900
2	30	Allis Ch.	AN	600
2	30	Gen. Elec.	KT336	720
2	30	Whse.	CS567C	1200
1	30	Gen. Elec.	K505	600
2	25	Gen. Elec.	KT312	1800
3	25	Allis Ch.	AN	1200
4	25	Allis Ch.	AN	900
2	25	Fair Morse b.b.	H10C	3600
2	25	Allis Ch.	AN	600

SLIP RING MOTORS

3 Phase—60 Cycle—220 or 440 Volts

Qua.	H.P.	Mfr.	Type	Speed
1	400	G.E. 2200 v.	I-P	1200
1	300	G.E. 3 brg.	I-P	450
1	300	Burke	EMV	225
1	200	Whse.	CW	600
1	200	Cr. Wh. 3 brg.	SR26Q	720
2	150	Triumph	SR	514
1	100	G.E. 2200 v.	I-E13A	1800
1	100	Gen. Elect.	I-M	600
1	75	Ideal 2200 v.	D120	1800
1	75	G.E. 2200 v.	I-E13	1800

SLIP RING MOTORS—Cont.

1	75	Cr. Wheeler	SR22Q	900
1	75	Allis Ch.	ANY	600
1	75	Gen. Elec.	MT558	600
1	75	Whse. b.b.	CW662D	1200
1	65	P & H b.b. int.	CA16	900
2	60	Whse. 2200 v.	CW657	1800
5	60	Gen. Elec.	M-505	1200
1	50	Gen. Elec.	MT536	1200
1	50	Al. Ch. bb. 2200 v.	ARY	900
1	50	Allis Ch.	ANY	720
1	40	Northw'n	HW35A	1200
6	40	Gen. Elec.	MT532	1200
2	40	G.E. 2200 v.	MT332	1200
1	40	Howell	SR	3600
1	40	Gen. Elec.	MT546	514
1	40	Fair. Morse b.b.	HV-M12C	900
1	35	Fair Morse b.b.	HV-12B	1800
2	30	Northw'n b.b.	HW404	1800
2	30	Allis Ch.	ANY	900
1	25	Gen. Elec.	MT322	1200
2	25	Allis Ch.	ANY	900
1	20	Whse.	CW	1200
1	20	Wagner	19TRS	900
1	20	Gen. Elec.	I-M	600

SYNCHRONOUS MOTORS

H.P.	Mfr.	Type	Volts	Speed
300	Whse.	ped.	220/440	900
250	G. E. 1 brg.	ATI	220/440	600
165	G.E. 3 brg.	TRB	220/440	450
100	Allis Ch.	8PF	220/440	600

60 CYCLE A. C. GENERATORS

KVA	Mfr.	Type	Volts	Speed
300	Whse.	ped.	240/480	900
250	Gen. Elec.	ATB	240/480	600
200	Gen. Elec.	TRB	240/480	720
125	Whse.	ped.	2300	600
100	Cr. Wheeler		240/480	600

A. C. GENERATORS

40	Burke		240/480	1200

SPECIAL—Frequency Changer 60-120 cycles

105 KW. Gen. Elec. ITT347, 120 cycles, coupled to 75 HP. G.E. motor 3-60-220/440 v.—1160 RPM.

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
90	Gen. Elec.	RC36	250	1200
75	Whse.	SK	250	800
75	Whse.	ped.	125	750
75	Whse.	SK	230	1800
60	Whse. (3)	SK	230	680
55	Bullock	ped.	250	900
50	Northern	B	125	650
50	Reliance	262T	230	1600
50	West. Elec.	E	230	850
25	Ideal Interpole		230	1150
25	Gen. Elec.	DLC	125	900
20	Gen. Elec.	RC31B	125	900
20	Gen. Elec.	RC	230	1150
16	Cr. Wheeler	CCD	125	415

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
100	Gen. Elec.	RC	230	1000
100	Gen. Elec.	DLC	230	575
75	Whse.	SK	230	600
50	National	CS	230	800
50	Northern	B	115	500/1000
35	Northw'n	B	115	1000
30	Bogue	Interpole	230	700
30	Reliance b.b.	185T	230	800/1600
25	Gen. Elec.	RC10	500	1500
25	Gen. Elec.	LC	230	1700
25	Roth	elevator	230	725
20	Fair. Morse	TR	230	325/1300
20	Whse.	SK	230	850

M-G SETS

250 KW Burke comp. interpole gen. DC 125V, coupled to 375 HP Burke synch. motor 3-60-220/440 V.—900 RPM.

100 KW Gen. Elec. 3 brg. unit, type RC gen. DC 125V, coupled to 150 HP I-K sq. cage motor 3-60-2300/4000 V.—1200 RPM.

90 KW Gen. Elec. RC 36 DC 250V, coupled to 135 H.P. G.E. sq. cage motor 2-60-220/440V. —1150 RPM.

13 KW Elec. Prod. b.b. gen. DC 60 V, 215 amp. coupled to 20 HP motor 3-60-220/440 V.

CENTRIFUGAL PUMP

8" Cameron 1500 gpm @ 250 ft. head on base coupled to 150 HP G.E. motor 3-60-220-v.-1900 RPM

ARTHUR WAGNER COMPANY

1436-38 W. RANDOLPH STREET — CHICAGO 7, ILL. — MONroe 7409

POWER PLANT INSTRUMENTS

Available for Immediate Delivery

1—Bristol Recorder Pyrometer—Model 437, Serial No. 7059, Range 75. 800° F., Chart 1103, Ohms Resistance Internal 102, External 15, Stamped 16-B (The Bristol Co., Waterbury, Conn.)

1—Brown Flow Meter, Model 222I, x-40, Serial No. 191067, Flow 0. 250 x 100, Total Flow x 3770, Chart No. 1055, 115 volts

1—Fluid Meter Indicater, General Electric, for Bailey Meter Company, Type FH, 60 cycles, Serial No. 851112

1—Thwing Electrical Pyrometer, Hundreds Fahrenheit 0-10 (Thwing Instrument Co., Philadelphia, Pa.

1—Bailey Fluid Meter on Heating Line, Type C-36, No. 51139, Chart No. 10006, Designed for steam at 200 lbs., 550° F. Temp., Chart reading x 100 lbs. per hr., Integrator Reading x 100 lbs. (Bailey Meter Co., Cleveland, Ohio)

1—Bailey Fluid Meter, Scale Plate No. 657030, Type F-12, Internal Pipe dia. 12.063 x 8 F.N. Inches, Pressure 195 lbs. Superheat 70° F., Use Chart No. 825 with Chamber T-1, Indicating Scale x 12400 lbs. per hour, Recording Chart x 12400 lbs. per hour, Dial Reading x 12400 lbs. in Total Flow

1—Bailey Fluid Meter, Type F-115, No. 701526. Feed Water Flow Nozzle, 6" x 2.5 in Venturi Tube, Temperature 190°—250 lbs. Pressure, Chart No. 825, Max. Differential 92.211 in. of Water, Indicating Scale x 10,000 lbs. per hr., Recording Scale x 16700 lbs. per hr., Dial Reading x 16760 lbs. per hr.—Fluid (Water)

3—Draft Indicators, Reads 1/100 of an inch, R.D. 1—Serial No. 2650-3300, R.D.1—Serial No. 265-3304, R.D. 1—Serial No. 2650-3299, (Republic Flow Meter Company)

1—Thwing Millivoltmeter, No. 4586, 1 scale—0 to 25, 1 Scale 0-80

4—Chelsea Meter Clocks, Nos. 174391, 151950, 152196, 156556 (Chelsea Clock Co., Boston, Mass.)

1—Simplex Water Meter with 6" Venturi Tube, 6" Tube—3" Throat, No. 6-58388 G.D.—No. 1064748 —65 lbs.—8 ounces (Simplex Valve & Meter Co., Philadelphia, Pa.)

1—Bailey Fluid Meter, Type MP-1340, No. 31069, 110 volts, 60 cycles, Steam, Nominal Pipe diameter 10" orifice, Serial No. 25696, Pressure 200 lbs., Superheat 125° F., Maximum Differential 53" water, Indicating Scale 0-60—Chart 7014, Indicating Scale—100 lbs. per hour, Recording Scale—1000 lbs. per hour, Integrator Reading—6000 lbs., Integral—31069; Indicator —85112, Recorder—931853, Integrator—14904914

1—Bailey Meter, Recorder Type, Prr No. 931855, 110 volts, 60 cycles

1—Fluid Meter Integrator, Type F-13, No. 14904914, 110 volts, 60 cycles

8—Thermacouples for 6 Pointer Pyrometer, Brown Electric Pyrometer No. 122331, Range 800 to 1200 F., Couple M.A., Chart No. 3347, Resistance of Instrument 192-297, External Resistance—35, Synchronous Motor—Type C-2, Motor 1 RPM, Model 33-M-783, Serial No. 7540, 110 volts, 60 cycles, W-6, 4 reels of cable for Pyrometer (Brown Instrument Co., Philadelphia, Pa.)

14-15 Coal Flow Counters, Type V-6, Serial No. 67189, Type V-6, Serial No. 39815

1—Keystone Continuous Flow Recording Oil Meter, No. 1014771 (Pittsburg Meter Co., East Pittsburg, Pa.)

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ELECTRICAL EQUIPMENT FOR INDUSTRY

LET US KNOW YOUR REQUIREMENTS

Special **150 KW MG SET** ***Special***

150 KW Westinghouse "factory built" Synch. Motor Generator Set, Type SK Generator for 250 volts DC compound wound interpole, 225 HP Type G Synch. Motor for 3/60/2300 volts, speed 900 RPM, complete with Westinghouse Switchboards.

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120 H.P.
ATLAS IMPERIAL
DIESEL POWER UNIT
650 RPM.

ROBERT SCHOONMAKER
Port Washington, L. I., N. Y.
ROSLYN 1220

DIESELS AVAILABLE

450 H.P.
BUCKEYE
GENERATOR UNIT
"O"
6 CYLINDER
13½ x 15½
360 RPM
300 KW 3/60/480—2300

262 H.P.
BUCKEYE
POWER UNIT
"E"
7 CYLINDER
9½ x 14
400 RPM
OBB & V SHEEVES
175 KW 3/60/480

3–150 H. P.
BUCKEYE
GENERATOR SETS
"E"
4 CYLINDER
9½ x 14
400 RPM
1—OBB & V SHEEVE
2—100 KW 3/60/240-2400

240 H.P.
BUCKEYE
GENERATOR UNIT
"70"
5 CYLINDER
10 x 12
514 RPM
150 KW 3/60/240

190 H.P.
BUCKEYE
GENERATOR UNIT
"70"
4 CYLINDER
10 x 12
514 RPM
125 KW 3/60/480

40-60 & 100 H.P.
BUCKEYE
GENERATOR SETS
"J"
2—3 & 4 CYLINDER
7½ x 10½
514 RPM
30—50 & 65 KW 3/60/240

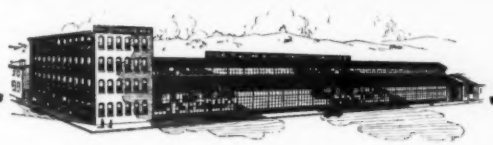
ROBERT SCHOONMAKER
PORT WASHINGTON, LONG ISLAND, N. Y.
ROSLYN 1220

TURBO GENERATORS

1—1000 KW 3 phase 60 cycle 480 volt 3600 rpm General Electric non condensing with board
1—750 KW General Electric
1—500 KW General Electric
1—300 KW General Electric
1—400 KW Moore extraction type

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit breakers, etc. Please send us your inquiries. What have you for sale?

KEYSTONE POWER PLANT EQUIPMENT CO.
8403 Hegerman St. Phila. 36, Pa.



AT YOUR SERVICE

120,000 SQ. FT. OF WAREHOUSE SPACE . .

. . . Housing our Complete Rebuilding Facilities . . . Also a wide range of Electric Motors and Power Plant Equipment

TODAY'S DEMAND FOR RECONDITIONED EQUIPMENT OBSOLETES OUR STOCK LISTING BEFORE IT CAN BE PRINTED

Write your requirements for

MOTORS—GENERATORS
MOTOR-GENERATOR SETS
ENGINE-GENERATOR UNITS

We will pay cash for like surplus equipment.

THE GLOW ELECTRIC CO.
933-943 HARRIET ST. Phone MA. 3024 CINCINNATI 3, OHIO

SEARCHLIGHT SECTION

BOILERS

1—1260 HP **B&W Sectional Header Boiler**, 250# pressure, underfeed stoker.
1—400 HP **Combustion Engineering**, 350# pressure, water-wall, Type E Stoker.
1—250 HP **Casey-Hedges**, 160 lb. pressure.
1—400 HP **Wickes** 3 drum low head boiler, 200# pressure with Chicago Spreader stoker. Installed 1932.
1—90,000# per hr. **Badenhausen Boiler**, 354# pressure.
1—357 HP **Heine** with Riley Underfeed Stoker.
3—253 HP **Vogt** low head **Boilers**, 225# pressure with oil burners, all auxiliaries. New in 1937.
2—300 HP **Heine** 175# pressure.
2—250 HP **Wickes** vertical **boilers**, powdered fuel.
6—600 HP 200# pressure **O'Brien** boilers.
1—394 HP **Sterling Boiler** chain grate stoker, 160# pressure.
1—585 HP **Erie City** vertical boiler 185# pressure, Type E stoker.
1—600 HP **Union Iron Works** 250# pressure **Chain Grate Stoker** new in 1936.
1—444 HP **Union Iron Works Boiler**, 225# pressure.
2—500 HP **Edge Moor Boilers** 200# pressure.
1—600 HP **Union Iron Wks**, 250# **pressure boiler**, chain grate stoker. New 1935.
1—624 HP **Edgemoor Boiler**, 200# pressure, underfeed stoker.
1—522 HP **Sterling Boiler**, 200# pressure with **Firite Stoker.**
1—640 HP **Heine Boiler**, 199# pressure.
1—484 HP **Springfield Boiler**, 250# pressure oil burners.
2—512 HP **Stirling** 200# pressure, completely rebuilt.
2—350 HP **Stirling** boilers with auxiliaries.
1—250 HP **Heine** boiler, underfeed stoker.
8—150 HP **HRT Boilers**, 150# pressure.
1—175 HP **Water Tube Boiler**, 160# pressure.
4—1010 HP **Heine** watertube **boilers** 250# pressure.
1—400 HP **Connolly Boiler** 160# pressure with new tubes and auxiliaries.
4—72" x 18' **HRT** boilers including a 637 KVA General Electric condensing turbine. Complete plant.
1—150 HP **HRT**, 125# pressure, rebuilt and guaranteed.
2—175 HP **Brownell HRT Boilers**, 150# pressure, rebuilt.

TURBINES

2—5000 KW **Westinghouse** 1800 RPM 3-60-2300 volts **Surface Condenser**, all auxiliaries.
1—3200 KW **Allis-Chalmers Condensing Turbine** with auxiliaries.
1—2500 KW **General Electric Condensing Turbine**, with auxiliaries.
15,000 KVA **Westinghouse** turbine, condenser.
1—1000 KW **Westinghouse non-condensing turbines** 350# pressure, 16# back pres.
1—937 KVA **Allis-Chalmers Turbine.**
1—625 KVA **General Electric Turbine** with jet condenser.
1—2000 KW **Westinghouse Turbine** with Surface Condenser and auxiliaries 3-60-440 volts.
1—300 HP **Kerr** Non-condensing 3600 RPM.
1—250 KVA **Waite Turbine** either condensing or non-condensing.
1—250 KVA **General Electric non-condensing Turbine.**
1—375 KVA **Waite Non-condensing** turbine.

ENGINE GENERATOR SETS

1—340 KVA **Skinner Uniflow Engine Generator** set with panel board.
2—200 KW 250 volt D.C. **engine generator sets.**
1—250 KVA **Ridgeway** engine generator set.
1—500 KVA **Allis-Chalmers Corliss.**
17 inch by 18 inch **Skinner uniflow engine.**
1—166 KVA **Ames Uniflow engine generator set.**
1—260 KVA **Skinner** uniflow engine.
1—625 KVA **Bates Corliss** engine.
1—7 ft. diameter by 175 ft. self supporting stack.

DIESEL ENGINES

1—200 KVA **Fairbanks-Morse** Full Diesel **Engine Generator.**
1000 KVA **Diesel** Generator Plant complete.
1—**Busch Sulzer** Full Diesel direct connected 1335 KW AC **generator**, rebuilt and guaranteed.
1,250 KVA **Nelesco** engine generator.

ENGINE GENERATOR SETS

1—625 KVA **Nordberg** Uniflow engine.
1—1060 KVA **Nordberg Uniflow Engine Generator.**

MISCELLANEOUS

54,000 pound **Cochrane** hot process lime and water softener.
2500 HP **Cochrane** Open Feed Water Heater.
1—10' x 15' **Illinois** Forced Draft Chain Grate Stoker.
2—6 **Retort Taylor Stokers.** First-class condition.
1—8 **retort Taylor**, brand new stoker.
1—800 HP **Hoppes** open feedwater heater.

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FLETCHER SALES CO.

325 Fincastle Building — LOUISVILLE, KY.

POWER PLANT EQUIPMENT CO., Inc.

39 Cortlandt Street
New York, N. Y.

A C TURBINE UNITS

6250 KVA G.E., 2300 V., cond.
3750 KVA G.E., 2300 V. cond.
3125 KVA G.E., 4100/2300 V. cond.
2500 KVA G.E., 2300 V. cond.
2500 KVA Al. Chal. 440 V. cond.
1875 KVA G.E., 2300 V. Cond.
1250 KVA (2) G.E., 2300 V. cond.
940 KVA Wghse. 6600 V. cond.
937 KVA G.E., auto BLEEDER, 2300 V.
937 KVA G.E., 2300 V. cond.
937 KVA Al. Chal. 2300 V. 300#.
780 KVA Al. Chal. 2300 V. cond.
625 KVA Wghse. 2300 V. cond.
375 KVA G.E., 2300 V. cond.
312 KVA Elliott 480 v. cond.
250 KVA Al. Chal. 480 V. BLEEDER.
150 KVA Wghse. 240 V. cond. (Non Cond.)
375 KVA G.E., 2300 V.
312 KVA C.W.—Moore, 450#, 240 V.
175 KVA Al. Chal.—Sturtevant 220 V.
75 KVA Al. Chal. 240 V.

BOILERS

749 HP (2) Edgemoor, 200#
728 HP Erie City, Ver. 200#
600 HP Connelly, 200#
522 HP Kidwell 207#, 3 drum.
471 HP Erie City Ver., 160#
396 HP B. & W., 160#
300 HP (2) Union Iron Wks. Cross drum 175#.
259 HP (3) Wicks ver.; 160# pulverizers.
250 HP Sterling, 160#
200 HP (2) Scotch Marine, 15#
Two 78" x 18' HRT 125# pulverizers.
850 HP B&W W. T. Boiler 250# with Riley Stoker.

DIESEL ENGINE SETS

500 KVA Wghse.—Busch Sulzer
375 KVA Wghse.—Busch Sulzer
312 KVA G.E.—Anderson
312 KVA G.E.—McIntosh Sey.
200 KVA G.E.—Busch Sulzer
170 KVA F.M.—F. M. "VA"
140 KVA E.M.—Fairbanks Morse "V"
100 KVA C.W. Bessemer
90 KVA (4) F.M.—F.M. "VA"
75 KVA Al. Chal.—International

BELTED

240 HP Fairbanks 35-E 6 cyl.
225 HP Chicago pneumatic 6 cyl.
80 HP (3) Fairbanks Style V. A.

GAS UNIT

44 KVA Caterpillar, 3-60-220 V.

SPECIAL

937 KVA G.E. 3-60-2300 V. turbo unit; surface condenser.
750 KVA G.E. 3-60-2300 V. turbo unit; surface condenser.
259 HP (3) Wicks ver. 160#, pulverizers, coal handling equipment.

STEAM ENGINE SETS (A C)

500 KVA (2) G.E.—24 x 48 Bates Corliss
375 KVA G.E.—22 x 27 Erie Ball, 4 V.
210 KVA G.E.—19 x 20 Skinner Unif.
150 KVA G.E.—16 x 15 Skinner Unif.
150 KVA G.E.—16 x 16 Skinner S.V.
125 KVA G.E.—12 x 21 Hamilton, 4 V.
100 KVA G.E.—14 x 15 Skinner Unif.

PUMPS (MOTOR DRIVEN)

7500 GPM 80' head
4000 GPM 70' head
3600 GPM 85' head
3250 GPM 425' head
3000 GPM 100' head
3000 GPM (2) 65' head
1390 GPM 231' head
850 GPM 243' head
750 GPM Hill 231' head
350 GPM 720' head

STEAM ENGINE SETS (D C)

450 KW C. W. 250 V.—Nordberg Unif.
300 KW G.E.—Skinner Unif.
150 KW G.E.—Erie Ball 4 V.
100 KW G.E.—Erie Ball 4 V.

AIR COMPRESSORS

2200 CFM Nordberg 100#, Steam and Motor Driven
1080 CFM Nordberg 85#—Motor
500 CFM Ingersoll 100#—Motor
"Steam and Gas Driven"; all sizes

TRANSFORMERS

687 KVA (2) Maloney 13800–460 V.
500 KVA (3) Al. Chal. 33000–440 V.
500 KVA (2) G.E. 6600–2300 V.
500 KVA (2) G.E. 11900/6900–230/460
250 KVA (2) G.E. 6600–2300 V.
150 KVA (2) Furnace Type 6600–90
150 KVA (5) G.E. 2300–120/240
100 KVA (3) G.E. 13200–2300
100 KVA (3) Al. Chal. 22000–440 V.
100 KVA (2) G.E. 13200/6600–440/600 V. & small sizes.
3 Ph. Transformers
750 KVA Wagner 6600–2200 V.
500 KVA (4) G.E. 13200–120/208 V.
300 KVA (2) G.E. 13200–120/208 V.

M. G. SET

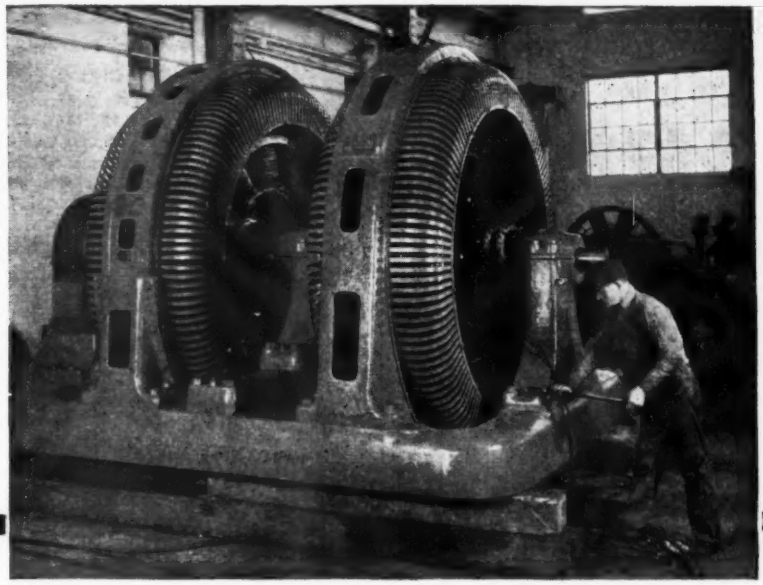
100 KW G.E. (two 50 KW 125V) with syn. motor.

Chicago Electric Offers

GUARANTEED REBUILTS

From An

UNSURPASSED STOCK!



Experienced buyers of rebuilt power equipment look for two things of prime importance . . . One—a company sufficiently skilled in rebuilding to offer completely guaranteed units . . . And two—an organization geared to supply almost any rebuilt unit *from stock.*

Chicago Electric offer rebuilt units with performance guaranteed "same as new" . . . And, the Chicago Electric stock is one of the most complete in the nation. The 1400 HP General Electric Frequency Changer shown above is an example of the quality rebuilding done in our shops . . . Investigate!

New 42 page illustrated stock listing just off the press is available free upon request. Send for your copy now!

CHICAGO ELECTRIC CO.

1320 W. CERMAK RD.
CHICAGO 8, ILLINOIS

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application

3 PHASE, 60 Cycle, 220/400 V.

HP	Make	RPM	Type	Frame
7½	Gen. Elect.	1200	KT	952
10	Gen. Elect.	720	K	404
10	Gen. Elect.	900	KT	312
15	West.	1800	CS	
20	Gen. Elect.	900	KG	405
20	Armor	900	ball bearing	
20	Fairbanks Morse	900	ball bearing	
25	Westinghouse	900	CS	444
30	Armor 2-phase	720	ball bearing	
40	Westinghouse	1800	CS	
50	Gen. Elect.	1800	IK	
50	Westinghouse	900	CS	505
50	Westinghouse	900	CS	646A
60	Gen. Elect	720	KT	548
60	West.	1800	CS	
60	Gen. Elect.	1800	I	form K
75	Gen. Elect.	1800	I	form K
75	Gen. Elect.	900	KT	552
100	Gen. Elect.	1800	I	form K
100	West.	1800	CS	
150	Gen. Elect.	1200	I	form K
150	Gen. Elect.	1200	I	form K

TRANSFORMERS

Amt.	Kva.	Make	Cycle	Voltages
3	25	Gen. Elect.	25	2300/115/230
3	50	Gen. Elect.	25	2300/115/230
3	75	Gen. Elect.	60	4600/230/460
3	100	Gen. Elect.	25	2300/115/230/460
3	100	Pittsburgh	60	12000/2300
2	100	Pittsburgh	60	2300/230/460
3	100	Westinghouse	60	2300/230/460
2	150	Westinghouse	25	2300/115/230/460
3	200	Gen. Elect.	60	2300/230/460
3	250	Gen. Elect.	60	13,000/2300
2	333	Westinghouse	60	2300/230/460
3	500	Pittsburgh	25	11,000/22(
4	833	Allis Chalmers	25	13,200/440
2	1500	Westinghouse	60	4000/2300/230
6	1667	Allis Chalmers	60	7200/12,470/2400 /4160

SPECIAL D.C. MOTOR

20—60 HP. Gen. Elect. DC. Variable Speed Motor 230 V. Type DMC. 6, Form A, 180-900 RPM with Controls.

MOTORS

3 PHASE, 25 CYCLE, 220/440 VOLTS

HP	Make	RPM	Type		Frame
1	Gen. Elect.	750	KT		926
2	Gen. Elect.	750	KT		731
2	Gen. Elect.	500	KT		934
2	Gen. Elect.	500	K		226
3	Gen. Elect.	500	KT		944
5	Gen. Elect.	750	KT		948
5	Gen. Elect.	750	KT		181
5	Gen. Elect.	1500	KT		948
7½	Gen. Elect.	750	KT		202
7½	Gen. Elect.	500	KT		964
10	Gen. Elect.	750	KT		512
10	Gen. Elect.	1500	K	(Ball bearing)	364
15	Gen. Elect.	750	KT		328
15	Gen. Elect.	750	KT		528
15	Gen. Elect.	1500	KT		303
20	Gen. Elect.	750	KT		327
25	Gen. Elect.	750	KT		333
25	Gen. Elect.	1500	KT		527
30	Gen. Elect.	750	KT		343
40	Gen. Elect.	750	KT		543
40	Westinghouse	1500	CS		6476
40	Gen. Elect.	750	KT		247
50	Gen. Elect.	750	KT		363
50	Gen. Elect.	500	I		Form K
75	Gen. Elect.	750	KT		357
100	Gen. Elect.	500	IM		Slipring
100	Gen. Elect.	300	I		Form K
150	Gen. Elect.	375	I		Form K
200	Gen. Elect.	500	IM		Slipring
200	Westinghouse	235	CW		Slipring
300	Westinghouse	500	CW	(22,000)	Slipring
350	Westinghouse	500	CW	(2200 v.)	Slipring
400	Westinghouse	500	CW		Slipring
500	Gen. Elect.	500	MT	(2200 v.)	Slipring
700	Gen. Elect.	500	ATI	(11,000 v.)	Sync.
1150	Gen. Elect.	375	ATI	(2300 v.)	Sync.

Mine Slope Hoist

1—Connellsville Mfg. and Mine Supply Hoist storage capacity for 11,000 feet 1" Rope—Speed 900' per minute.
Motor 500 HP Gen. Elec. Mt. Slipring 3/60/2200/450 RPM. Complete with remote control. Herringbone reduction gears and demountable base and drum.
Write Wire Phone

MOTORS

25 cycle-3 phase-2200 volts

100 H.P., General Electric, type KT558, 750 rpm, serial number 5227257, ball bearing.

100 H.P., Allis Chalmers, type AR, ball bearing, 1500 rpm, serial number 42209K426N-1-1.

125 H.P., General Electric, Ball bearing, type KT549Y 1500 rpm, serial number 5227356.

150 H.P., General Electric, ball bearing, type KT557Y, 1500 rpm, serial number 5269756.

150 H.P., General Electric ball bearing, type KT557Y, 1500 rpm, serial number 5227355.

150 H.P., General Electric, ball bearing, type KT557Y, serial number 5227357, 1500 rpm.

ALL COMPLETE WITH CRI034K17 COMPENSATORS.

MOTOR GENERATOR SETS

1—125 KW Ridgeway 250 V. DC. 1200 RPM Motor 3/440/60/1200 Complete.

1—100 KW Westinghouse Synchronous-Generator 250-275 V. DC—Motor 3/60/2300/900 RPM complete with panels.

FREQUENCY CHANGER SET

1—1250 KVA Gen. Elec. Synchronous—motor 3/25/2200 750 RPM direct connected to Generator 362½/440 V. Complete with exciters and panels.

200 KW., 25 CYCLE, M. G. SET

200 KW. Gen. Elect. Generator, 240 V. DC. 750 RPM. Type MPC. on Factory Base direct connected to 300 HP. Gen. Elect. Type I Form K. 3/25/440 V. 750 RPM. Complete with Motor Starting Equipment and DC. Panels.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

SLIP RING MOTORS

3-HP., 60-CY

HP	Volts	Make	Speed
900	2200	G.E.	900
500	2300	Whse	514
450	2300	G.E.	600
400	2300	Whse.	1200
350	220–440	G.E.	1800
300	2200	G.E.	1800
300	2200	Whse.	514
250	2300	G.E.	600
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2200–400	G.E.	600
150	440–220	G.E.	1800
150	440	G.E.	1800
150	550–2300	G.E.	1800
150	550	G.E.	720
125	440–220	G.E.	900
100	550–2200	G.E.	720
100	440–220	G.E.	1800
100	220–440	G.E.	720
100	220–440	G.E.	900
75	220–440	G.E.	900

SYNCHRONOUS MOTORS

3-PH., 60-CY.

600	2200	Whse.	900
350	440–220	G.E.	900
300	440–220	Al. Ch.	600
200	2300–4000	G.E.	1200
110	440	Whse.	900
100	2300–550	Al. Chal.	1800
75	440–220	G.E.	720

PUMP

1—8" Dredge Pump 1880 GPM, 120' Morris Machine Works with direct connected Slip Ring Motor 125 HP, 600 RPM, G.E.

OUTDOOR OIL CIRCUIT BREAKER

1—New 400 Amp. Type FK, 136-1328A, General Elec. 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's PT's, etc.
1—3000 ampere, type FK 25, General Electric, 3 pst, 600 volt

TRANSFORMERS

60 CYCLE

3—500 kva., G.E., type H, form KS, 13800-230/460
3—500 kva., Whse., 22000-2300.
3—350 kva., G.E., type H-KD 13200-4600.
3—333 kva., G.E., type H-KDD 2400-460/230
3—250 kva., Whse., 13,800-460.
3—200 kva., G.E., type H 10000-600.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
3—175 kva., G.E., 4000-480.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Chal., type OISC 10400-2400.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—100 kva., G.E., type H 2400-240-480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., Whse., 22,000-2300.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse., type SK, 13800-240/120.
3— 50 kva., Whse., 22,000-2300.

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
550	440/220	G.E.	IK	900
400	440	G.E.	KTP	1200
400	2200	Whse.	C.S.	1800
300	2200	G.E.	IE-K	1800
250	2200	G.E.	IK	600
250	2200	Whse.	CS	1200
250	440/220	G.E.	IK	1800
200	220/440	G.E.	IK	720
150	2200	Allis Ch.	AN	450
150	440/220	Whse.	CS	514
125	440/220	G.E.	KT	1800
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
60	550	G.E.	FT	3600
50	220/400	G.E.	K	1800

MOTOR GENERATOR SETS

2—150 kw, 125 v., 1200 rpm, Whse., conn. to 230 hp, 440/220 v., 3 ph., 60 cy., syn, very modern, practically new.
75 KW, 125 V. 1200 RPM Westinghouse Conn. to 112 H.P. 2300/440 V. 3 ph. 60 cy. Ind. motor.
1—75 KW 250 V. 1800 RPM, Cr. Wh., Type CCD con. to 100 H.P., 2200 V., 3 ph., 60 cy. syn.

A.C. GENERATORS

1—500 kva., 900 r.p.m., 2300 V. Whse. Condenser.
1—300 kva., 900 r.p.m., 240/480 V., G.E.
1—225 kva., 600 r.p.m., 2200-240 V., G.E.
1—110 kva., 900 r.p.m., 440 V., G.E.
1— 60 kva., 720 r.p.m., 240/480 V., G.E.
1— 25 kva., 3600 r.p.m., 220 V., G.E.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

POWER PLANT EQUIPMENT

Turbo-Generators

1—4000 KW GE Cond. 2300 V.
1—3000 KW GE Cond. 600 V.
1—1250 KW West Cond. 440 V.
1— 750 KW West Cond. 6600 V.
1— 600 KW GE Cond. 600 V.
1— 500 KW GE Cond. 600 V.
1— 500 KW GE Cond. 125 V. DC.
1— 400 KW West Non-Cond. 480 V.
1— 200 KW GE Cond. 2300 V.
1— 100 KW GE Cond. 600 V.
1— 75 KW GE N.C. 125 V. DC.

Turbines Only

1—210 HP Terry 250#
1—175 HP GE 110#
1—225 HP Terry with gears

Boilers

1—750 HP Heine 200# Stoker
3—318 HP Manning Type 170#
1—300 HP Heine 250# Stoker
1—150 HP HRT 150# Grates

Air Compressors

1—1214 CFM 100# Motor Driven
1— 825 CFM 100# Steam Driven
1— 600 CFM 500# Steam Driven
1— 386 CFM I.R. Steam Driven

Centrifugal Compressors

10000 CFM 33# Turbine Driven

Pumps

2—300 GPM 65' Hd. Motor Driven
1—1500 GPM Fire Pump Steam
1—1000 GPM Fire Pump Steam

Engine—Generators

1—600 KW GE 2300 V.

Miscellaneous

1—4100 Sq. Ft. 2 Pass Surface Condenser
3—Sets of 78" Perfection Stokers for 84" HRT Boilers. New 1943

Also transformers, engines and cranes

Send us your Inquiries

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always

SYNCH. CONVERTERS

500 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
200 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
150 KW G.E. 275 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

200 KW G.E. IND. 600 V. 2300/4000 A.C. 1200 RPM
200 KW RW SYN. 250 V. 2300/4000 A.C. 900 RPM

Each unit listed above is owned by us and is available now for immediate purchase.

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Diesel Plant. Total 1100 HP. in 4 units.
2000 KW Turbo unit 250# 200° F. I.H. 2300 v.
600 HP. Boiler 250# Stoker, etc.

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STEAM—ELECTRIC—HYDRO—DIESEL

SPECIAL OFFERINGS

4—1900 HP Heine 225# Boilers
2— 750 H.P. Edge Moor 200# Boilers
2— 600 H.P. Edge Moor 200# Stokers
2— 600 H.P. B. & W. Sectional 200#, with Stokers
1— 600 H.P. B. & W. Stirling 200#, with Stoker
2— 550 H.P. Keeler Long Drum 160#
6— 440 H.P. B. & W. Sectional 200#, Oil fired
1— 335 H.P. B. & W. Sectional 200 Boiler
Smaller Boilers and Fire Tube Boilers also

1—5000 KW., G.E. Co., Turbo-Generator Condensing
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ATLAS DIESEL
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514 RPM.

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POWER PLANT EQUIPMENT

3 Engines and Generators Direct Connected

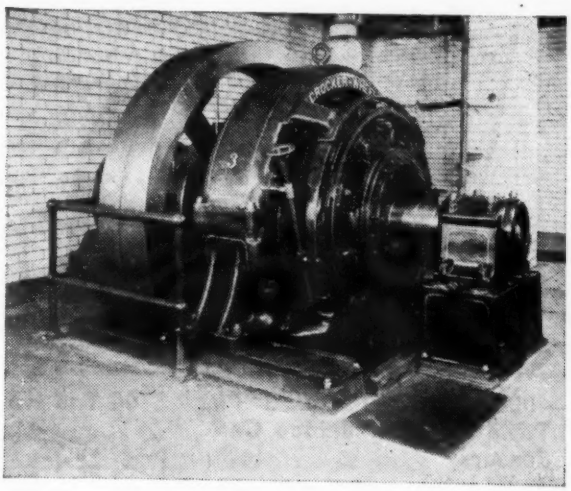
ERIE BALL ENGINE—GENERATORS

	Cylinder	K.W.	R.P.M.	Floor Area	Depth Foundation	Pipe	Weight
#1	18x27	200	150	19'9"x14'3"	5'0"	6"	30,200
2	20x27	250	150	22'3"x15'3"	6'0"	6"	52,500
3	20x27	250	150	22'3"x15'3"	6'0"	6"	52,500

GENERATORS—CROCKER WHEELER

Direct Current

	Number	Size	Type	K.W.	R.P.M.	Volts	Amp.
#1	244005	269D	CCD	200	150	250	800
2	246216	252D	CCD	250	150	250	1000
3	245083	252D	CCD	250	150	250	1000



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STOKERS—Brand New in Original Crates

3—Skelly, Center retort underfeed stokers, heavy duty moving grate type as follows:

2—Class 7-CH-80, 84" long x 80" wide, 46.7 sq. ft. of grate area capable of burning 1375 lbs. of bituminous coal per hour, to develop 370 boiler horse power, using coal with a value of 13,000 BTU.

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Stokers are complete with cast iron fronts, fire and ash doors, integral forced fans, 220 volt, 60 cycle, 3 phase, A.C. motors, controls and instrument panel.

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500 KW. NON-COND. 60 CY. TURBO.

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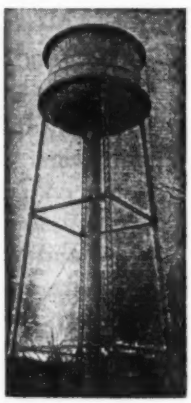

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1—6" Oil Separator.

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2—75 H.P.
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3/60/240

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1—G.E. 50 HP 1200 RPM 3 phase 60 cycle 220 Volt
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3 phase, 60 cycle, A.C.

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470 KVA Westinghouse Turbo Generator Set.
Generator: 3 phase, 60 cycle, 480 volt, with direct connected exciter.
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Complete with Size No. 1 Westinghouse LeBlanc Condenser.

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300 GPM, 50' head 1750 RPM

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7, 7½-yd. cap. Allis Chalmers Speed-Ace Tractor Wagons
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60,000 gallon Water Tank on 89'9" tower, with 10" riser pipe

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100 KW. 125/250 volt 3-wire D.C. Westinghouse synchronous 25 cycle set.

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Special Offering

1—23" x 24" Ames Unaflow Non-Condensing

Direct connected to a 250 KW Crocker-Wheeler 250 volt DC Generator. Installed new 1931. Exceptionally fine condition.

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105—2½"	I.P.S.	210— 8"	I.P.S.
70—3"	I.P.S.	50—10"	I.P.S.
100—4"	I.P.S.	35—12"	I.P.S.
65—5"	I.P.S.	60—20"	I.P.S.

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125—2½"	I.P.S.	105— 8"	I.P.S.
160—3"	I.P.S.	60—10"	I.P.S.
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From 4" to 24"—Thousands in stock for immediate delivery.

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275 feet long, in perfect condition.

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Steam & Motor Driven—Various Sizes.

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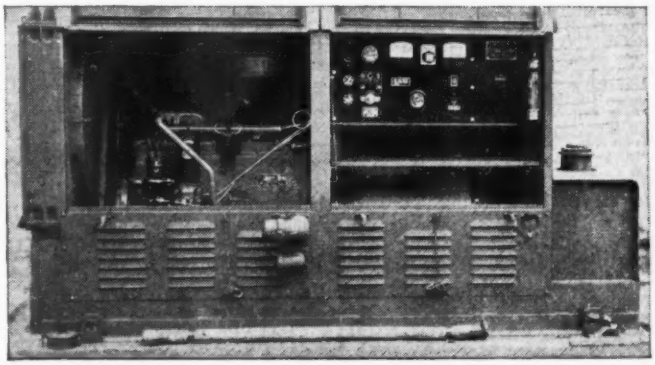

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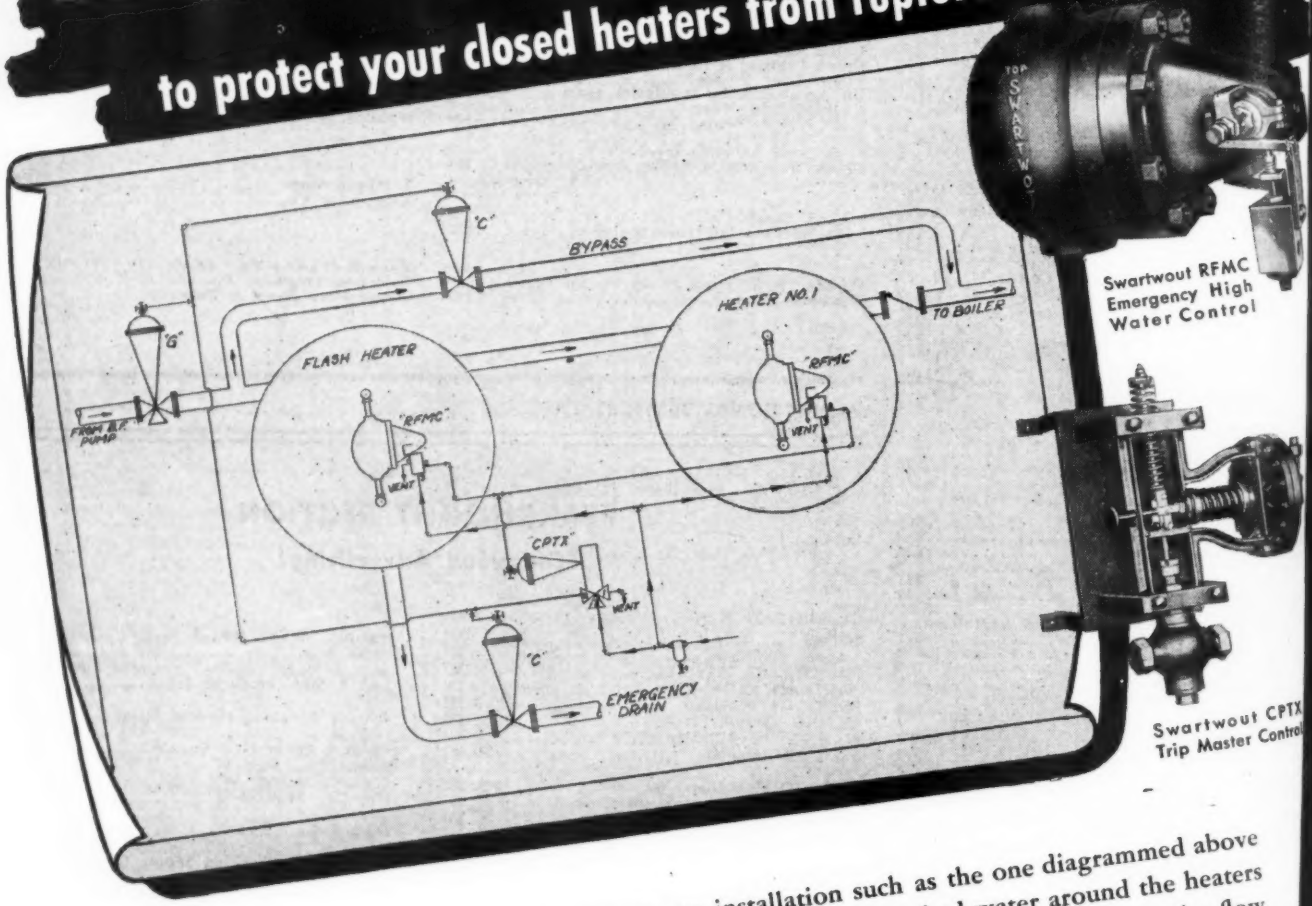
Faster than you can say "RFMC and CPTX"-

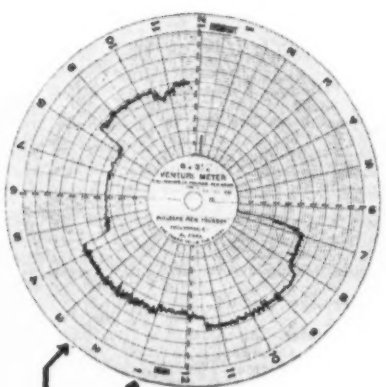
THESE SWARTWOUT CONTROLS *act promptly, dependably*

to protect your closed heaters from ruptured tube damage



Swartwout RFMC Emergency High Water Control

Swartwout CPTX Trip Master Control



Heater cut out
Cut back in

Under actual tests, an installation such as the one diagrammed above operated in 1½ to 2 seconds to direct the feed water around the heaters —and water loss was stopped. Hardly a hesitation shows on the flow chart at left when heaters were completely bypassed. • That's the protection you can have for your closed heaters when a ruptured tube will cause a critical loss of water on high pressure operation. • Swartwout RFMC Emergency Controls and CPTX Trip Master Controls, included in your hookup through the help of Swartwout engineering experience, also "bypass" a lot of lost time and expensive repairs. They guard feed water supply in many important power plants. • Other Swartwout equipment in this installation includes two types of sturdy quick-acting 900 pound control valves, and a drainage valve rated at 300 pounds. Write for further information about Swartwout feed water control ideas.

Swartwout POWER PLANT EQUIPMENT

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